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THE ECONOMY OF A LARGE HAMPSHIRE ARABLE FARM

C. H. BLAGBURN, B.Sc.(Agric.), N.D.A.
Department of Agricultural Economics, Reading University
and
R. S. BOYER, N.D.A.
National Agricultural Advisory Service, South-Eastern Province

By using the intensive methods commonly associated with the smaller holding, output on this 800-acre arable farm has been raised to 50 per cent above the area average. Profits per acre are more than double those of similar farms in the area.

MUCH has been said and written about the comparative productivity of large and small farms, and generally speaking there is little doubt that the value of output per acre from the small farm is considerably higher than that from the larger holding. This is almost inevitable, for it is only by maintaining a high intensity of production that the small farmer can get the turnover necessary to keep him in business. The farmer with many acres, on the other hand, does not need a big profit per acre to provide a reasonable standard of living, nor, in many cases, has he the very large amount of capital necessary to maintain production at such a high level. Nevertheless, figures for the past four years from an 800-acre Hampshire arable farm show conclusively that by practising a system of farming generally regarded as "extensive", it is quite practicable for a large farm to achieve an output far in excess of the general level of production in the country, and to do so very economically.

The farm is situated on the Hampshire chalk belt, with a quarter of the acreage "clay with flint", notably as clay caps on the higher ground. The remainder is typical thin upper chalk with about six inches of soil. The basis of the farming system is the mechanized production of corn and herbage seeds, supplemented by a large poultry unit and the rearing and fattening of beef stores, mainly on the by-products of corn growing and seed production.

Of the 800 acres, rather more than half is usually under cereals (at least two-thirds in barley). With the exception of about 40 tons which is kept back for poultry feed, all this corn is sold. About 20 acres of potatoes are grown, and the rest of the farm (apart from about 6 acres of permanent grass) is under leys, of which 220 acres are cut for seed each year. Some 24 acres are water meadows which have been reseeded from time to time.

The rotation is flexible, but the basis is two corn crops followed by a "rest", or, when a field has been down to ley for several years, three corn crops and a "rest". The rest is generally a seed production ley, or occasionally it may

be mustard or rape for seed, linseed or potatoes. The duration of the seed production leys depends upon the type of grass being grown. Normally perennial ryegrass leys are left down for one seed year (only very occasionally, if an undersowing fails, is it retained for a second harvest year), but two seed crops are taken from cocksfoot and meadow fescue and three from timothy before the leys are ploughed out. Early in the war the farmer introduced lucerne, and since then about 20 acres of this crop have been grown regularly and used mainly to produce silage for the beef cattle. When the lucerne is to be grazed, access is always given to a ley as a "lie-back".

The mixtures used for these seed production leys are :

(1) 12–14 lb. S.23 perennial ryegrass and 2–4 lb. S.100 white clover ; (2) 10 lb. S.37 cocksfoot ; (3) 10 lb. S.215 meadow fescue and 2 lb. S.100 white clover ; (4) 8 lb. S.48 timothy and 2 lb. S.100 white clover. The cocksfoot ley is sown in 21-inch drills, timothy in either 6-inch or 12-inch, and ryegrass and meadow fescue in 6-inch drills. Cocksfoot is cut for seed with a binder and stooked in the field, but all other grass seed crops are windrowed and then harvested with a combine harvester fitted with a pick-up reel. It is also the normal practice to grow one piece of pure Hampshire broad red clover every year. The first cut is taken for hay and the second for seed.

A considerable part of the hay taken from the herbage seed area is sold and fetches a surprisingly good price, in spite of the fact that it is obviously not of the highest quality. The remainder is used, with lucerne silage, for wintering bullocks. About 90 head of cattle are bought in at about eighteen months old in the late summer. These graze the aftermath of the leys and are wintered on silage and rough hay. A certain number are sold off as forward stores in spring, the remainder being carried through to the autumn, generally increasing in value by about £20 per head. A fresh batch is bought each year.

The poultry unit consists of 2,000 layers. These were originally kept in fold units on the leys but, when the fold units needed replacing, the policy was changed. There are now 1,100 birds in batteries and 900 birds in yards. Rhode Island Reds or Rhode Island Red × Light Sussex were used in the days of the folding system, but in the batteries and yards of the present system a light-heavy cross (usually a Leghorn × heavy) is favoured. Several other crosses are being tried and a final decision on the most suitable bird for the conditions prevailing on this farm has not yet been taken. The birds are kept for one year only and the replacements are reared on the farm. Every endeavour is made to have them out on the leys from 12 weeks onwards. The poultry unit is highly economical of labour, the work being carried out by one man and a boy. The yield per bird works out at about 167 eggs a year.

Output 50 per cent above Normal The average value of gross production on this farm for the four years ended March 1952 was approximately £31,000 per year, or nearly £39 per acre, comparing with about £26 per acre as the average gross output for arable farms of this type in Hampshire. This is about 50 per cent above normal. About 75 per cent of the output is obtained from corn and seeds, 15 per cent from poultry and eggs, and the remainder from cattle.

Three main factors—high crop yields, intensive use of leys and the integration of a large poultry unit—account for this high level of production. By efficient technique, including the liberal use of fertilizers, crop yields have been raised well above the average for the district. The fertilizer bill for the past four years has averaged well above £5 an acre over the whole

farm, which is more than double the normal figure for this type of farm. But this expenditure has been justified by results.

Spring barley is sown with 2½ cwt. of a complete fertilizer, winter wheat with 2 cwt. of the same fertilizer, together with 3 cwt. sulphate of ammonia as a top dressing, and spring wheat with 2½ cwt. of complete fertilizer and a top dressing of 2 cwt. sulphate of ammonia. Average yields per acre are : wheat 11.8 sacks ; oats 16.1 sacks ; and barley 12.2 sacks. The potato crop receives 15 cwt. of complete fertilizer per acre and averages 8.3 tons per acre of ware sold.

The fertilizer policy for the herbage seed crops varies according to (*a*) the type of grass grown, and (*b*) the harvest year. The following are average types of dressings applied.

Perennial ryegrass leys are undersown and, in the autumn when the corn has been harvested, the ley receives a dressing of 4 cwt. National Compound No. 1. Two cwt. "Nitro-Chalk" per acre is applied the following spring. The cocksfoot leys are sown without a cover crop and with 4 cwt. National Compound fertilizer per acre. No further dressings are given until the following spring, when the crop is top dressed with 4 cwt. sulphate of ammonia. For the second year's seed crop a further 6 cwt. sulphate of ammonia is applied.

A weakness on many large arable farms, especially where there is no dairy herd, is the poor use that is made of the acreage of ley which has to be carried for rotational purposes. This farmer, by the production of herbage seeds, supplemented by cattle rearing and fattening, has found a use for this acreage which makes his farming system a great deal more productive without, at the same time, increasing his operating costs very much. Taking seeds, cattle and hay sales together, the output of the grass area on this farm has averaged about £22 an acre during the past four years. Grass seed production is, of course, a specialized business, and not all farmers similarly situated will be able to adopt this particular system. But there are other ways of making more profitable use of the ley break than is frequently found in practice.

The addition of a large poultry unit is another means of expanding output without a proportionate increase in costs. Food, labour, and other direct expenses, are, of course, additional (though with 400 acres of cereals probably 25 per cent of the food is cheap, second-quality corn), but the overhead charges of the farm are not affected by the poultry unit.

Additional Expenditure more than Repaid Naturally, it has not been possible to maintain so high an output without some additional expenditure. The average large arable farm in this area is spending about £21 an acre, of which about £7 is for labour, £4 10s. for machinery operating costs, £2 each for feedingstuffs and seeds, nearly £2 10s. for fertilizers, and the remainder on rent and general expenses. The average expenditure per acre on this farm during the past four years has been between £26 and £27 per acre, or £5–6 above normal, but as gross production has been £13 per acre above average, this additional outlay has obviously been fully justified. It is worth noting that practically the whole of the additional costs on this farm are accounted for by fertilizers and feedingstuffs, the latter, of course, being due to the poultry unit. So far as labour and machinery costs in combination are concerned, this farm, with a 50 per cent higher output, has been worked at a cost only fractionally above the average (about £12 10s. per acre), with the result that for every £100 net

output, labour and machinery costs amounted to only £38, compared with a normal figure of about £52.

The labour force for the years 1948–50 was 9 men, all living in cottages attached to the farm. Since 1950, a farm mechanic has been employed, as well as a boy to help with the poultry. Thus the present labour force is 10 men and 1 boy, made up by 1 foreman, 5 regular tractor drivers, 1 poultryman, 1 mechanic, 2 general farm workers (who also do some tractor driving), and the boy.

Production per man is exceptionally high, gross output being nearly seven times the wages bill (compared with three to four times on the average large arable farm) and net output nearly six times labour costs (compared with a local average of about three times). A high degree of mechanization is, of course, partly responsible for the economy in labour. There are six tractors (four diesel-engined), two combines, a new pick-up baler, and the normal range of farm implements. The two combines, which were originally 8 feet 6 inch models, were replaced this year by two 12 feet machines. The drying and storage plant enables the farmer to get through the peak of the harvest without employing extra labour. The drier has an output of 4 tons per hour, and the grain storage consists of eight silos with a capacity of approximately 50 tons each. One silo is usually left empty to allow for moving grain as required.

Great stress is laid on the importance of autumn cultivations on this farm. As soon as the corn is combined a rotary hoe is used to break the stubble and incorporate the straw ready for ploughing. Two rotary hoes are kept for this purpose and, because of the highly-mechanized harvesting methods, two tractor drivers can be spared to work these continuously.

High input and low costs combine to give a profit for the farm averaging during the past four years over £12 per acre and about 36 per cent of net turnover. This compares very favourably with the average of large arable farms in the area of around £5 per acre or 23 per cent on net turnover. Largely because of its high mechanization, this farm is much more heavily capitalized than normal, the value of live- and dead-stock standing in the balance sheet at £42 per acre, compared with an average figure of £22 for this type of farm. Even so, the percentage return on capital was 27 per cent, compared with a normal figure of about 20 per cent.

PORK PRODUCTION

WALTER SMITH, B.Sc., N.D.A.
National Agricultural Advisory Service, Eastern Province

The pork pig is coming into its own again as a result of the premium payable on fat pigs up to 6½ score dead weight. Importance lies in starting with the right kind of pig, rearing well and marketing at about five and a half months.

THE production of pork in Great Britain before the war considerably exceeded that of bacon and hams combined. The comparative figures in 1937, a typical year, were about 4 million cwt. of pork, and 3 million cwt. of bacon and hams. Whilst the marketing of bacon pigs from 1933 onwards was regulated by the Pigs Marketing Board, the supplies and prices of pork pigs were allowed to find their own levels. The Ministry of Agriculture, however, in an attempt to encourage farmers to produce good quality pork, organized a voluntary scheme for the grading of pork pigs and payment on a deadweight basis. This scheme was brought to an end by the outbreak of war. Under war-time policy and control by the Ministry of Food, all suitable pigs were directed to bacon factories. The pork market was therefore almost entirely eliminated and shortage of feedingstuffs did not permit its return until early this year.

The present position, which has operated since March 30, 1953, is that a pork premium of 8s. per score above the standard price, at present 52s. 10d. per score, is payable on pigs weighing between 5 score 16 lb. and 6 score 15 lb. carcass weight " if they are suitable for the retail pork trade." For pigs up to 5 score 15 lb. a reduced premium of 4s. 6d. is applicable. Farmers have not been slow to take advantage of the market created, and large numbers of pigs during the last three months have been available for the fresh pork market at the expense (so it is stated) of supplies for the bacon trade.

A study of the pre-war pork trade compared with that today indicates that the present weight range is a compromise between three distinct pork weights formerly required. These were : (1) the London market—3–4 score dead weight; (2) the rather heavier "porker" market—5–7 score dead weight; (3) the "heavy porker" trade—7–8 score dead weight.

The last two classes were more popular for the provincial trade, particularly in the North and Midlands. It remains to be seen just how the market will develop within the next few years, but the trend in demand will probably be for the 5–5½ score pig. At the moment, however, price encouragement is for the heavier pig, and it is with the production of this class of animal that this article is mainly concerned, although some reference to specialized pork production from pork breeds will necessarily be made.

The ideal pork carcass has a general white appearance with firm flesh and a high proportion of lean meat ; the loin is firm and muscular, the hams nicely rounded, the head and neck free of loose flesh ; the shoulders need not be so fine as in a bacon pig, but should not be so heavy as to involve a likelihood of too much fat. The skin must be free from wrinkles and the lean flesh a bright attractive colour.

The right kind of Pig The standards required in a live pork pig are fairly well understood by British farmers, probably better than in the case of bacon pigs. Although a shorter pig fulfils the requirements fairly well, it is desirable that the back should be fairly long so that the back fat is not more than about ½ inch thick ; the loin and ham must be

well developed. To obtain these characteristics, it is essential to select a pig with well-sprung ribs.

A newly-born pig appears to be all head and legs, and has a short shallow body. As it develops the body proportions change. With adequate feeding the body lengthens and later deepens, while the muscles of the legs remain undeveloped for a time. Later, the muscles of the upper part of the leg grow quite fast compared with the muscles lower down, but in the case of pigs destined to produce good hams the lower muscles grow quite rapidly afterwards. Thus there are early and late developing parts of the body. The loin grows rapidly in a well-nourished suckling pig and the head remains relatively small. The various tissues grow at differing rates—that is, bone makes growth early, then muscle is laid down, and finally fat growth quickens as the pig becomes more mature.

Breeds and strains within breeds vary in the manner that these changes take place. The pork breeds like the Middle White and Berkshire, which are early maturing, pass through these phases quite quickly, compared with the later-maturing bacon breeds and types like the Large White. At 100 lb. live weight, therefore, the Middle White can be a well-proportioned finished pig of similar body proportions to the Large White of nearer 200 lb. This brings us to the question of breeds and crosses for pork production.

It must be said at once that for a pork pig of the weight required at the moment, the Large White and the first cross or "blue and whites", which form the mass of our commercial fattening pigs, are generally suitable, provided they are reasonably well bred and reared. If and when the pre-war lightweight carcass is wanted, the specialized pork breeds, like the Middle White and Berkshire, and the earlier-maturing strains of some of the other breeds, will again come into their own, perhaps not always as pure breeds but probably as foundation female stock for mating with the Large White boar to produce first crosses for fattening. The popular pig for the London pork trade used to be one of 100 lb. live weight at about four months old.

The right kind of Rearing The effect of different standards of nutrition on growth and carcass quality has been studied experimentally by Dr. Hammond*. Well-nourished pigs reached 200 lb. live weight in 168 days, whilst those on a low plane of nutrition took 315 days. The fast growing animals produced carcasses with a higher proportion of loin to head, greater development of thigh, and higher ratio of fat to bone. The experiments also showed that pigs given a good start and later given adequate but restricted feeding produced carcasses with a high proportion of lean to fat.

The deep milking sow is the first essential in this good start. In these days when we hear so much about creep feeding there is a tendency to think that the creep food is a replacement for milk. Breeders must still contrive to select for milking ability. In fact it is the well-fed piglet which comes earliest to creep feeding and consumes most. The total weight of the litter at three weeks, when milk secretion is at its peak and creep feeding is only beginning, is largely a reflection of the milking capacity of the sow, and therefore some guide to selection. The actual creep food must be the best quality available ; the quantity is small and cost is not a vital factor. The efforts of a good sow backed up by creep feeding, with a normal litter of 8–10 pigs, results quite often in average weaning weights of 40 lb. or over.

* JOHN HAMMOND. *Farm Animals*. Edward Arnold.

Many pig-keepers regard the post-weaning checks as inevitable, but the fact that the pigs are accustomed to solid food, coupled with gradual weaning during the last week, may mean the elimination of the check to growth, or at any rate render it scarcely noticeable.

We have now had time to assess the value of the most recent of our artificial aids to farrowing and rearing, namely, the infra-red lamp, and the consensus of opinion indicates that it is a means of stepping up numbers reared by at least one per sow. Their value for the first fourteen days is unquestioned, but discretion in use is needed afterwards, otherwise "soft" pigs susceptible to chills may result.

In pork production, as in bacon production, there must be no serious check to growth from birth to slaughter, but the following troubles cause appreciable loss to the industry : anaemia in suckling pigs, lung troubles (e.g., pneumonia), worm infestation, and paratyphoid. Space does not permit these to be dealt with in detail, but the important point is that good husbandry is the best insurance against them. Observation on many farms over a number of years leads one to believe that sound systems of rearing would do much to improve the health of our store pigs. Evidence from farms is clearly in favour of outdoor breeding and early rearing on "clean" land with movable units, or at least some modification of the system. Losses from simple nutritional anaemia are eliminated, and it is reasonable to assume that we should hear much less of virus pneumonia, paratyphoid infection and worm infestation if this fundamentally sound practice was more widely adopted. If indoor rearing is unavoidable, then dosing with iron compounds at 3–4 days old for the prevention of anaemia, and with sodium fluoride against round worms at 10–11 weeks, are both necessary. Work at the Rowett Research Institute over a number of years in connection with prevention of ill-health amongst pigs reared indoors emphasized the need to maintain body temperature. In other words, warm comfortable conditions of housing are a vital factor.

Some Observations on Feeding and Management The present pork weight range is encouraging marketing at 170–180 lb. live weight, giving a 6–6½ score carcass, which normally thriving pigs should achieve at about five and a half months. Feeding and management need not differ from those adopted with bacon pigs—that is, two levels in quality of meal, a "No. 1" sow and weaner, and a "No. 2" fattening meal. In practice, there is some doubt as to the best weight or age at which to change from one to the other, although experiments at Cambridge and elsewhere have shown that with pigs given a good start on all meal feeding, it has been safe to do so at the 90–100 lb. stage. Under varying farm conditions, however, it appears that 120 lb. is about right.

There is a good deal of discussion as to whether young stores should be penned in a fattening house from an early age or given a fair degree of freedom of movement for a time in large boxes or covered yards. Here it cannot be overstressed that pigs should be housed warm and comfortably, and since so many of our fattening houses are relatively cold, the running of groups of pigs in well-bedded covered yards is to be preferred. Conversion rate, or the number of pounds of meal required per pound of liveweight gain, is a highly important factor in economic pig production. Self-feeding is a practical proposition under these circumstances until the pigs are confined in fattening quarters at about 4–4½ months old, when restricted feeding, which is desirable from the carcass quality point of view, can be practised until the animals reach pork weight.

SELF-FEEDING OF SILAGE

CHARLES TURNER, N.D.A., N.D.D.

Assistant County Agricultural Officer (Advisory), Buckinghamshire

Hand-feeding of silage is laborious, expensive and unpleasant. Self-feeding is a possibility being explored on at least one Buckinghamshire farm.

IN the usual kind of weather we get in Britain, silage-making is a more efficient means of conserving grass than making it into hay. But many farmers are complaining of the cost and unpopularity of feeding silage every day during the winter. Self-feeding of silage is the complete answer—by which is meant that the cattle help themselves to the silage *ad lib.* from the silo without manhandling of the material in any way. Once in the silo, whether stack, clamp or pit, the silage is in fact "untouched by hand" before conversion into milk or flesh.

Untouched by Hand or Machine Two advantages of the self-feeding system are immediately obvious. First, the elimination of the cost in labour and machines of taking the silage from the silo to the cattle. Last winter a survey was made of the methods and cost of feeding silage on twenty-three Buckinghamshire farms. This cross-section included all types of silos and methods of handling. Ten of the farms had clamp silos, eleven pit silos and two stack silage. Nine of the silos were at the buildings, the remainder in the field. In thirteen cases the silage was fed in the buildings and the remainder in the field, and the distance of the feeding point from the silo varied from 25 to 880 yards. Sixteen of the farms used tractor and trailer, four used horse and cart and three fed by hand trolley.

The cost per ton varied tremendously, from 3s. where a hand trolley was used from a silo adjacent to a cowshed to 36s. where a heavy four-wheeled-drive petrol lorry had to be used because of the difficulty of getting to the pits in the field. The average for the whole of the farms worked out at 15s. 4d. per ton, and although this average figure is of comparatively little use, it can be taken as a rough indication that in the winter of 1952-53, with approximately 22,000 tons of silage in the county, Buckinghamshire farmers spent about £16,500 to get that silage from the pit to the animals' mouths ! A sum well worth saving ; and at the same time men and machines would be released for more productive work.

In the second place, improved conditions of work can be equally important to the industry as reducing the cost of production. This is particularly so if an efficient and contented labour force is to be maintained in agriculture, and the removal of the daily, and often unpleasant, chore of silage carting and feeding in winter will go a long way towards overcoming the unpopularity of the winter handling of silage—not only with the men themselves but with their womenfolk too !

When I was in the U.S.A. in 1951 I was interested in what the Americans were doing in this matter of self-feeding silage. Most of the silage was being made in tower silos, but pits and clamps are increasing in popularity, and I saw several farms where self-feeding was being practised with these two types of silo. Not in all cases was the self-feeding one hundred per cent, but the original work was sufficiently impressive to indicate that self-feeding could often provide a solution to the winter handling and feeding of silage in this country. The principle is that the animals eat their way through the pit

or clamp or from openings at the bottom of the tower ; in the latter case the silage being replaced from above by gravity. The approach to the problem by one farmer was interesting. He said, " Any fool with sufficient dollars can mechanize silage feeding, but that isn't the problem ; it must be solved on these lines without machines as well as without labour". And the same thing applies in this country. The capitalization and maintenance cost of machinery on many farms today is already alarmingly high without adding to it, and it is of nearly as great importance as labour cost. " Untouched by machine " is therefore one of the essentials of self-feeding silage.

Self-sufficiency for ruminant animals means providing more and better quality forage, and not feeding more home-grown concentrates. The latter are essential to pigs and poultry, but with cows and sheep the scope lies in the better production and use of grass and other forage crops. The self-feeding of silage meets these requirements admirably. One of the first principles of self-feeding is 24 hours-a-day access with *ad lib.* consumption. Under these conditions cattle will eventually consume as much silage as they do grass when grazing ; provision should be made for an average daily consumption of approximately 1 cwt. per animal.

Of equal importance is self-sufficiency at reduced cost. A good deal has been done to save labour and improve utilization by grazing grass over a much longer growing season. Under conditions suitable for outwintering, the same advantages can be obtained from the winter grazing of brassica crops—again at consumption rates of over 1 cwt. of kale per animal per day.

Where does the self-feeding of silage fit into the management picture ? At the present stage of the work it is believed to be more on the heavy land farm and where the weather is unfavourable to outwintering. With yarded stock, self-feeding is comparatively simple ; one of the first essentials is a hard bottom ; where dairy cows are concerned, preferably concrete. Store cattle on light land can successfully feed themselves from a stack or clamp silo in the field, but it will be appreciated that the plough is the only answer over a considerable area of the field where it has been practised, and a ley in its last year is therefore preferable. The introduction of self-feeding may accordingly involve considerable reorganization of farm policy. The tonnage of silage made will have to be substantially higher than usual—30 cwt. per cow per month can be taken as a guide.

A stack, or preferably a draw-over clamp, has to be made at the buildings. If the use of the buckrake has to be continued (and this is really a "must" in silage-making), fields within "buckraking" distance of the buildings will have to be cut. This will mean the cows being pushed to fields farther away. Under these circumstances, is there a possibility of using a portable bail in the outlying fields in the summer months and returning to a concrete base at the buildings for the winter ? All such questions of farm planning and management will in the long run have to be fully considered in the development of any self-feeding programme.

Experience at Hipe Farm The following report is given of a small self-feeding silage trial carried out this year at Hipe Farm, Moulsoe, Bucks, with the enthusiastic co-operation and interest of the occupiers, Messrs. Houghton Bros. This, it is believed, is the first attempt at 100 per cent self-feeding in this country, and it should be clearly understood that the figures recorded are purely exploratory and are given here largely to stimulate other farmers to give the method a trial. Unfortunately, during the greater part of the trial the farm was in a foot-and-mouth area and so the records are incomplete.

The farm extends to about 103 acres and was then carrying a small dairy herd of approximately 15 cows and young stock. The land is heavy and the stock yarded in winter. A covered yard is available, and to accommodate the silage and provide an outside area, a concrete apron was laid down next to the yard, fenced as required by temporary movable fencing (poles slung between 40 gallon drums of water). The herd was very mixed, comprising Jerseys, Shorthorn-crosses and Friesians. This gave a big weight variation which, from the trial angle, was fortunate, since the effect of "boss" cows could be observed. The silage was in a stack about 8 feet high, very dense, (55 lb. per cubic foot) dry and of good quality. The herd had access to the silage face 24 hours a day and the "face" of silage was adjusted to give sufficient feeding room. Under these conditions there is, of course, no rush to feed, the cows simply going to and from the stack during the day and night as they feel inclined.

Feeding at the Face After some experimenting, about 14 inches of silage face was allowed per cow. American figures are lower than this (6 inches per cow approximately) but their silage is chopped and therefore more readily pulled. The trial was started on January 30, and continued until March 10 (a total of 38 days), when an early piece of Italian ryegrass was available. It is important to have sufficient silage to carry the herd through to the grass, otherwise yields will suffer. The herd was not in a high milking period, the 13 cows in milk producing 28 gallons per day when the trial began. No strict rationing was carried out, silage to appetite, about 4 lb. of hay in the manger at the start of the trial, with grass cubes to the higher yielders. The stack had been partially opened up on one face down to cow level when the herd was turned in for full self-feeding. The milk dropped from 28 to 24 gallons, and it was obvious that this sudden transition was rather harsh, as the cows did not know how to feed. Two feeds were given in the mangers, by which time most of the cows had found out what was expected of them. The milk yield again rose to 26 gallons.

It should be noted that smooth surfaces, as left by the hay knife, cannot be tackled by the cattle ; the surface should be rough. The height of the stack (8 feet) was soon found to be too high for full self-feeding, so it was reduced in height by hand to about 6 feet, at which height the larger cows were quite happy. American practice provides movable manger bars, electric fence wire, etc., to keep the cattle about 18 inches–2 feet back from the silage face—so preventing waste by treading—and it was intended to sling a movable pole between 40-gallon water drums in this trial. The fence was not, however, erected when the trial started, and since no loss was observed in the first day or so, it was decided to carry on without it. There was not more than a handful of waste during the whole period. The silage was tight and the only way of describing the cows' method of obtaining it is to say that the silage face was "grazed". As with grass, small mouthfuls only could be obtained and these were immediately consumed. It is only when loose hay, straw or silage is fed that waste underfoot results.

One point was soon obvious—the contented nature of the herd, which at the end of the trial consisted of 16 cows and 3 yearlings. There was no rush to feed, no horning and very little bullying of any kind. The herd was too varied in weight and breeds for completely satisfactory results, and it was thought that one or two of the lighter cows were kept away from feeding by master cows standing near the silage although not feeding. The general condition of the herd improved and milk yield was well maintained.

Just over 23 tons of silage were consumed during the period, giving an average consumption of 86 lb. per day. This was rather lower than expected, and it will be interesting to study further results during the coming season on more level herds. But averages are only guides and too much stress must not be placed on them.

Analysis of Feeding at Hipe Farm

No.	Name	Estimated Weights *cwt.*	Hours Eating Daily	Daily Milk Yield Start *lb.*	Daily Milk Yield End *lb.*	No. of Times Feeding in 24-hour Period
1	Birdie	6	sick	21	sick	—
2	Lynn	7	3.65	33	26½	38
3	Sally	8	5.30	20	19½	34
4	Molly	8	4.05	21	21	22
5	Maggie	10½	4.15	dry		17
6	Madge	9	4.35	dry		28
7	Hyacinth	6½	4.63	27	23	30
8	Nellie	7	3.35	13½	7	22
9	Pride	11½	3.81	30	29½	12
10	Welcome	12	8.38	13½	dry	22
11	Bluebell	10	4.68	26	24½	21
12	Hope	11½	7.96	dry	43	12
13	Crocus	6½	2.76	4	dry	13
14	Gem	8½	2.60	24	19	12
15	Firefly	6½	1.96	22	21	8
16	Nicky	7½	1.85	20½	12	3
	Darky	hand-fed *ad lib.*		dry	37	

These figures give an indication that some of the larger cows will consume in self-feeding quantities well over 1 cwt. per day. Cows 15 and 16 were smaller Jerseys of a timid nature and were obviously not having a fair chance. Possibly, it would have been better to exclude them from the averages, but as has been said at the start, these results are given more to stimulate interest than convey accuracy. It is obvious that much more work will have to be done in self-feeding methods before definite conclusions can be drawn.

Average Daily Yield of Milk

Week ended	Herd Total *lb.*	Cows in Milk *No.*	Av. per cow *lb.*
February 1	265	14	19
February 8	217	12	18
February 15	257	13	19¾
February 22	315	13	24
March 1	320	13	24½
March 8	296	13	22¾
March 15	290	13	22¼

What of the future of self-feeding at Hipe Farm ? Messrs. Houghton are enthusiastic and have made provision for the coming winter. Their " forage farming" programme will be based on this "help yourself" system, for example :

Early spring	Italian ryegrass	Strip grazed
Summer	3–4-year leys	" "
Autumn	Kale grazing	" "
Winter	Silage	Self-fed

A little home-grown grain will also be fed, and this has averaged about 2 cwt. per cow over the last few years, but no concentrates have been bought. Most of the milk will be produced from the large bulk of high-quality fodder,

fed without the expense of machinery or labour. Individual yields of 1,500 gallons have been recorded in the herd with this type of feeding.

One of the brothers, when asked for his comments on the self-feeding of silage replied : " It's just like summer; all we have to do is milk 'em! ".

A satisfactory testimonial for the first attempt.

THE MANURING OF GLASSHOUSE TOMATOES

W. DERMOTT, M.SC.

National Agricultural Advisory Service, South-Eastern Province

A careful manuring programme for glasshouse tomatoes will repay its cost many times over : but there are many pitfalls to be avoided. Some recommendations based on experience in south-eastern England are given here by Mr. Dermott, Soil Chemist at the Wye sub-centre.

IT is no exaggeration to say that a suitable manurial programme, although a relatively small item so far as cost is concerned, is nevertheless one of the most important factors in determining the profitability or otherwise of the tomato crop. Despite the large amount of information obtained by research stations and the experience accumulated by growers over many years, difficult manurial problems arise in practice, partly due to the fact that although the crop is to some extent concentrated in areas such as the Lea Valley and the Worthing district, tomatoes are also grown under a very wide range of soils and climate. The suggestions made in this article are largely based on experience in the important glasshouse districts of south-eastern England, and may not apply equally in other areas.

Importance of Suitable Potting Loams Little need be said about the manurial aspects of the propagation of tomato plants, important though the subject is, because many growers nowadays use standard propagating mixtures of the John Innes type which can generally be relied upon to give excellent and uniform results. It is perhaps doubtful whether it is worth mixing a special seed compost for tomatoes, since they can be sown and grown on satisfactorily in a good potting compost, but a few points about the loams used in potting composts are worthy of mention, as this is the commonest source of trouble. The top spit from grassland on fairly heavy soil is generally agreed to be ideal; but it is difficult to obtain and, in desperation, growers sometimes use materials which are too light, strongly acid or highly infertile. In such circumstances it would often be better to obtain material from good arable land, provided it is not too sandy. Although the tomato is tolerant of slight soil acidity, lime (in the form of finely ground chalk or limestone) should be added at the time of building the loam stack if the *p*H value is below 6.0.

Another problem which occasionally arises is the production of excess ammonia after the loam has been sterilized by steaming or baking. This can damage the root systems of plants, although the tomato is not nearly so liable to injury from this cause as are many bedding plants (for example,

antirrhinums, pansies, stocks, salvias) and rooted cuttings. Rich organic soils, such as those from marshland pastures, should be avoided as being likely to release large amounts of ammonia after steaming or baking. Some batches of "second soil", old cucumber bed and the like, are equally suspect. Another disadvantage of using too rich a loam (or giving too much nitrogenous fertilizer) for tomato propagation is that the plants may become rather soft, and, although it may perhaps sound old fashioned, there is still a good deal to be said for having planting-out material a little on the hard side particularly for the earliest crops. Sometimes, too, when heavily manured soil is used as the basic loam the addition of fertilizers to produce a potting compost is sufficient to raise the total salt concentration to a level which may damage the root systems of young plants.

In the early stages the tomato plant requires a lot of phosphate, and if superphosphate is inadvertently omitted from the compost, the plants may turn blue and fail to grow. This condition has to be distinguished from that produced by cold growing conditions, but in true phosphate deficiency an almost miraculous cure can be achieved by watering the pots with a suspension of 1 oz. superphosphate per gallon of water.

Although not strictly a manurial question, it is worth noting in passing that the loam must be in good physical condition when the compost is mixed. This is particularly important where soil blocks are used, because if the compost is too wet when handled by the block-making machine it tends to smear and form an unsuitable rooting medium for plants. In addition, the type of sand used must permit of easy drainage, although the term "sand" is a little misleading, because what is actually required is a relatively coarse grit free from lime, salt and the like.

Base Manuring It has been shown by Owen* that a 40 ton crop of tomatoes (including leaves, stems and fruits) removes from the soil approximately 344 lb. of nitrogen, 75 lb. of phosphoric acid (P_2O_5) and 672 lb. of potash (K_2O). This is roughly quivalent to 24 cwt. of hoof-and-horn (or 15 cwt. of sulphate of ammonia), 4 cwt. of superphosphate and 12 cwt. of sulphate of potash. In addition, some allowance has to be made for losses of nitrogen to the atmosphere or in other ways, fixation of phosphates and potash, and leaching of nitrogen and potash from the soil. It is probable that fixation is relatively unimportant in soils that have been heavily manured over a long period, and there is also good reason to believe that losses from leaching are small on the many nurseries where winter flooding is not thoroughly carried out.

In practice, dressings of fertilizers greatly in excess of the figure given above are often applied, more especially so far as phosphates are concerned, and over the years toxic fertilizer residues may accumulate in the soil.

Of course, many factors influence the base manuring of tomato houses in addition to the actual requirements of the crop, as, for example, whether the house is sterilized by steam or chemicals, the variety of tomato grown, date of planting, and freedom of the soil from disease.

NITROGEN AND POTASH The main substances to be considered in base manuring are nitrogen and potash, phosphates, magnesium, lime and farmyard manure (or other source of humus). The first two of these are discussed together because in a sense they are opposite in their effects—that is to say, the action of nitrogen in producing vigorous growth can to some extent

* O. OWEN. *Ann. Rep. exp. Res. Sta., Cheshunt*, 1925, 111–6.

be offset by heavy dressings of potash, which tend to have the same hardening effect as strong sunlight. In the average tomato house which has been built for some years, there are usually substantial reserves of potash in the soil. Where such conditions are known to exist or are revealed by soil analysis, it is unnecessary and undesirable to give heavy dressings of potash.

Hoof-and-horn and sulphate of potash are useful sources of nitrogen and potash respectively for the base manuring of tomatoes, and normal dressings would be 8–10 cwt. of each per acre. A similar amount of potash and a greater quantity of nitrogen should subsequently be given in top dressings. More potash in relation to nitrogen should be given in the earliest planted houses for the strong-growing Sunrise varieties and where soil analysis reveals low reserves of available potash: less potash in relation to nitrogen would be given in late-planted houses, for the weaker-growing Potentate group and where available potash reserves in the soil are particularly high.

The most difficult manurial problem, however, follows steam sterilization, when large amounts of ammonia may be produced. This will, in turn, give rise to sappy growth and difficulty in setting the bottom trusses. The harmful effects of steaming are likely to be much more pronounced where soils contain large amounts of organic nitrogen (or, more strictly, where the carbon/nitrogen ratio is narrow) either naturally or as the result of previous manuring. When steam sterilization is only carried out very occasionally, the release of nitrogen in an available form from such organic compounds is particularly high, and in such circumstances it is advisable to omit all nitrogen from the base and merely give sulphate of potash at the rate of 12 cwt. per acre. When growth is expected to be excessively vigorous, however, there is much to be said for tackling the problem by reducing the nitrogen supply to the plant in addition to applying potash. This may best be accomplished by digging chopped straw (at the rate of 3–4 tons per acre) into the soil prior to planting. Where steaming is carried out regularly, however, a much smaller release of ammonia can be expected, and it is often necessary to give a light base dressing (4–6 cwt. per acre) of hoof-and-horn.

Difficulty in getting the bottom trusses to set is not uncommon on some soils, even where steam sterilization has not been carried out. Here it is wise to omit nitrogen from the base, although if this is done it must be borne in mind that a nitrogenous top dressing will be required much earlier than usual.

PHOSPHATES AND MAGNESIUM After the early stages the tomato has a relatively low demand for phosphates. Many tomato soils, however, contain an excess of readily available phosphate, and, although this may not be particularly harmful in some circumstances, in others it may help to cause "blotchy ripening". On many soils, therefore, dressings of phosphatic fertilizers can safely be omitted for several seasons but, when necessary, bonemeal at the rate of 8 cwt. per acre, or a rather smaller dressing of superphosphate, could be given. Apart from the small percentage of nitrogen in bonemeal, there is no reason to believe that it is a better phosphatic fertilizer for tomatoes than the quicker-acting superphosphate.

The yellowing of the leaves of tomato plants due to magnesium deficiency is well known to growers, and in mild cases is not particularly harmful. But when it begins early in the life of the plant, it can seriously affect the top trusses and lower fruit quality by increasing the incidence of "greenback". The high potash level frequently found in glasshouses tends to induce magnesium deficiency, and, in addition, the large amount of water which is applied washes out available magnesium from the soil. Any form of damage

to the root systems of tomato plants may produce magnesium deficiency symptoms in the tops.

Magnesium deficiency is best controlled by spraying the plants four or five times during the growing season with 1.5–2 per cent (15–20 lb. per 100 gallons) magnesium sulphate solution to which a "spreader" has been added. Spraying should be carried out on bright days (when the solution dries quickly on the leaf) to reduce the risk of scorching. The deficiency may also be controlled by base dressings of magnesium sulphate, but since a dressing of up to 1 ton per acre may have to be applied, and as this could have harmful effects on soils where the soluble salt concentration is already at a dangerously high level, it is generally better to rely upon spraying. Relatively light dressings, say of the order of 5 cwt. magnesium sulphate per acre, may prevent serious magnesium deficiency.

LIME As already mentioned, tomatoes are tolerant of a degree of soil acidity, and it is probably unnecessary to lime if the *p*H value is above 6.0. On the other hand, care should be taken to see that strongly acid soils are limed if they are to be steam sterilized, as under such conditions toxic amounts of water-soluble manganese may be released in the soil, giving rise to stunted plants with black lesions on the stems and leaves and chlorotic growing points. On acid soils, high-grade ground magnesian limestone could be used with advantage instead of the more usual types of lime, since this supplies magnesium as well as correcting the acidity. It should be remembered, however, that magnesian limestone is usually produced far away from the glasshouse centres, so that heavy transport costs may have to be borne.

Where crops such as lettuce and chrysanthemums are grown in rotation with tomatoes, the *p*H value should be maintained at a slightly higher level than that suggested above.

An excess of lime in the soil, like an excess of phosphate, may aggravate blotchy ripening and, in addition, can induce iron and manganese deficiencies. Hydrated lime has been widely used in glasshouse work for many years, but finely ground chalk and limestone can also be recommended as satisfactory cheap liming materials.

FARMYARD MANURE AND OTHER SOURCES OF HUMUS One of the greatest difficulties of tomato growing on some soils is to maintain a good soil structure, since the heavy watering given to glasshouse crops tends to break down the crumbs and form a "cap" on the surface, thus hindering further penetration of water and air into the soil. Heavy dressings of bulky organic manures help to prevent this loss of structure, and it is long-established practice to give periodic dressings of strawy horse manure, not only to improve structure but also because of its plant food content. There is considerable prejudice against other forms of animal manure, but strawy cow manure, at any rate, appears to be satisfactory on many soils. Farmyard manure should rarely be applied if steam sterilization is to be carried out. If given before steaming, it may tend to increase the production of ammonia, and if after, diseases may be introduced into the freshly sterilized soil. Farmyard manure is generally given at the rate of 30–60 tons per acre.

Other materials which are sometimes applied to glasshouse soils as sources of humus are compost, peat and straw. Valuable compost may be made from the waste products of a market garden, but any material from the

potato or tomato crop should definitely be excluded because of the danger of introducing disease into the glasshouse. Straw may either be chopped and dug in or, where the problem of water penetration is particularly serious, used for straw walls either between each row of plants or between each double row of plants. It should be emphasized that working straw in, as opposed to straw walling, may seriously reduce the available nitrogen content of the soil. Unless this effect is desired, extra base nitrogen should be applied.

Top Dressings The subsequent manurial treatment of the tomato crop consists of several top dressings of fertilizers given throughout the growing season, normally at intervals of 10–14 days, beginning 6–8 weeks after planting. The first feeds, particularly in early-planted houses and when growth is soft, should be mainly potash, but as the season progresses less potash and more nitrogen should be given until, by the time the plant is fully grown, it is on a wholly nitrogenous feed. A suitable programme for average conditions would be to start with a mixture of 3 parts sulphate of potash and 1 part sulphate of ammonia (or sulphate of potash alone) and gradually reduce the proportion of potash until sulphate of ammonia only is being used. The above mixtures should be applied at the rate of 1–2 oz. per square yard and well watered in. In dull weather the amount of potash should be increased in relation to nitrogen, and the reverse in bright sunny weather.

Sulphate of ammonia has proved to be a satisfactory and cheap nitrogenous feed for tomatoes, but hoof-and-horn or dried blood may be substituted (at slightly heavier rates) by those who prefer nitrogen in the organic form. It is worth mentioning that a number of growers delay their first nitrogenous feed too long and consequently run the risk of losing one or more trusses in the middle of the plant.

It should seldom be necessary to give top dressings of a phosphatic fertilizer, as the requirements of the crop can be met by a base dressing.

A fairly recent advance in the manuring of tomatoes is the use of liquid feeds injected into the irrigation water. This saves a good deal of labour as compared with dry feeding and, although there is still a lot to be learnt, it seems probable that this method will grow in popularity. There are a number of liquid feeds on the market, the majority of which contain phosphates as well as nitrogen and potash. If growers wish to make up their own liquid feeds, it should be possible to use potassium nitrate (approximately 12 per cent nitrogen and 40 per cent potash) early in the year and gradually increase the proportion of nitrogen by adding sulphate of ammonia (20.6 per cent nitrogen) until, finally, sulphate of ammonia only is used. Half an ounce of fertilizer per gallon of water should probably be regarded as the upper limit of concentration for liquid feeds. In general use they are applied very much weaker.

Mulching During the growing season tomato crops are frequently mulched to conserve moisture in the soil and prevent "capping" of the surface. The materials commonly used are strawy manure, straw, spent mushroom compost and peat. The latter is particularly effective so far as retention of moisture in the soil is concerned, but it is necessary to break the force of water coming from the hose in some way otherwise the mulch may be washed away. Animal manure can be used since it supplies a certain amount of plant food, but adequate ventilation must be given for a few days after application to allow ammonia to escape. If this is not done the leaves

may be scorched. Better still, the manure can be spread in a thin layer for a time before being brought into the house.

Spent mushroom manure can make a useful mulch, although there is reason to believe that substantial dressings can seriously increase the soluble salt content of the soil. Care should also be taken to check that no insecticide or fungicide has been applied in the growing of the mushrooms such as could cause damage to the crop on which the spent compost is subsequently used. For example, DDT is extremely poisonous to members of the cucumber family. Mulches have a cooling effect on the soil and should not, therefore, be applied in the early part of the season.

Some Other Problems Finally, it is necessary to discuss the manurial aspects of two of the more important problems of tomato growing—"blotchy ripening" and toxic concentrations of soluble salts in the soil. "Blotchy ripening" is a complex problem, probably with several distinct causes. Some cases appear to be due simply to lack of moisture, and respond to a better system of watering and also to mulching. In others, however, shortage of potash appears to be the cause, either directly or, more usually, as a result of excess nitrogen preventing the uptake of potash by the plant. Any factor such as excess nitrogen giving soft and vigorous growth is liable to produce blotchy fruits. Too much lime and phosphate in the soil may, as already mentioned, help to induce "blotchy ripening", as also may severe magnesium deficiency. "Greenback" also appears to be associated with magnesium and/or potash deficiency. Both these troubles are often worse where, because of disease or eelworm attack, the root system of the plant is faulty.

In recent years it has been realized that fertilizer residues may accumulate in glasshouse soils to such an extent as to damage the root systems of plants and be responsible for a form of "soil sickness". In soils with a moderately high concentration of soluble salts (which may be measured electrically) growth is observed to be rather hard, but where the concentration is exceptionally high, plants are seen to flag in bright sunlight and sometimes to collapse completely. Such cases, of course, have to be carefully distinguished from those due to the presence of a primary disease organism.

Fertilizer residues, such as sulphates, are probably mainly responsible for the long-term build-up of soluble salts, but there is little doubt that the condition is aggravated by nitrate nitrogen during the summer, both from the application of inorganic nitrogenous fertilizers and the decomposition of organic nitrogenous fertilizers and farmyard manure. A careful manurial programme should prevent this problem from arising, but if the condition is already established it may take several seasons of very light fertilizer applications to restore the soluble salt concentration to a safe level. Thorough winter flooding (probably not less than the equivalent of five inches of rain per acre), preferably applied by means of a spray-line, should help to remove soluble salts from the soil. But in severe cases the only solution may be re-soiling.

A NEW SOMERSET RIVER

GEORGE JARRETT
Clevedon, Somerset

In May the Minister of Agriculture officially opened what is known as the New Blind Yeo at its outfall into the Bristol Channel at Clevedon Pill. This ceremony marked the culmination of many years of agitation and controversy concerning the draining of the low-lying moorlands to be found in this part of North Somerset.

SOMERSET is characterized by a wide diversity of soils, farming and scenery. Of its total lowland acreage of approximately 156,000 acres, some 16,000 acres are liable to serious flooding, and these periodical inundations prevent such areas being properly farmed. Apart from the moorland areas liable to flooding, the county has many thousands of acres of flat, heavy, alluvial soils with clay subsoils which are liable to suffer from waterlogging by heavy winter rains. There are a number of moors stretching from the north of the county down to Sedgemoor, forming the catchment areas for the waters which drain from the surrounding higher land. These, in turn, merge into ranges of hills such as the Mendips and Poldens. It will be appreciated that, in a county containing so many low-lying areas, an efficient drainage system is the key to an unassessable accumulation of fertility. Man cannot farm against water, whether it is fresh or salt.

For those not familiar with Somerset conditions it may be as well to review briefly the main features of the county's drainage system. The many thousands of acres of heavy, alluvial land not actually liable to flooding are divided or enclosed by ditches or rhynes. The fields themselves are again drained by what are known as "gripes". These are drainage channels cut across the field, sometimes in regular formations but in other cases cut in a fashion which, to the uninitiated, appears to be without plan or reason. On closer inspection and study, it will be found that older generations dug them after careful observation of the very slight falls present. Some of these gripes are comparatively shallow, across which implements may be taken without being damaged ; others may be so deep that crossing is possible only at certain places.

From the fields the gripes carry the surface water to the surrounding ditch, whence it will in turn drain into a main rhyne or river and so into the sea. These main rhynes are of such importance to the efficient drainage of the land that they are inspected, or "viewed", as the local term is, several times a year by a drainage official, whose job it is to see that all weeds growing in them are cut and removed. This operation is known locally as "keaching". In North Somerset weeds grow faster than in other parts of the county, and this imposes more work on the farmer responsible for their removal. As yet, no suitable mechanical means have been devised to ease this manual burden—work that has to be done anything from once to six times a year, according to the importance of the rhyne and the rate of weed growth.

The main waterways are controlled by hatches under the operation of a local supervisor. His job is to pen back or release the waters as required and to superintend the keaching in his area. Water in this type of country is required not only for drinking purposes, but also as a means of dividing fields. Water-filled rhynes and ditches are stockproof, but if they are allowed to become low or empty stock will force their way across them whenever they can. One of the technicalities of controlling the water hatches is to know when to let the water go and when to pen it back. It requires only 12–24 hours of heavy rain in some districts to cause floods if the hatches

have not been opened. Thus constant supervision must be maintained by someone with local knowledge and experience. The proverbial ounce of practical experience is worth many tons of theory in such work.

The responsibility for drainage is divided between the Somerset River Board, with its headquarters at Bridgwater, and local internal drainage boards. The former is concerned with all the main rivers and the sea-walls, whilst the local boards are entrusted with the subsidiary drainage systems and with the levying and collection of drainage rates. The latter are often a matter of contention, inasmuch as farmers on the low-lying lands say that they have to pay rates to help drain the higher lands ; they also have to do the work (or pay for it to be done) on any rhynes for which they may be liable.

Much has been accomplished in the county in the long fight against flooding but a great deal remains to be done. Thousands of acres still flood badly every winter and are useless for six months and sometimes longer every year. In abnormally wet summers the moors have even flooded in August. However, when on May 11 this year the Minister of Agriculture came down to Somerset to open the river officially known as the New Blind Yeo, another milestone along the road towards victory over flooding was laid.

Why was a new River Necessary ? Responsibility for drawing up the scheme for the New Blind Yeo fell upon Mr. E. L. Kelting, O.B.E., the Chief Engineer of the Somerset River Board. Ably assisted by a staff of assistant engineers, he now sees what at one time was but a complicated tracery of lines upon a plan becoming a glistening streak of water stretching inland from the sea near Clevedon for a distance of about three miles.

The scheme has been designed to provide satisfactory gravity drainage and irrigation for the Kenn and Tickenham Moors, which comprise some 2,100 acres of land liable to flooding. The beneficial effects of this new river will be felt over an additional 4,000 acres, and a further 6,000 acres of higher land will also drain to it. The actual land drained by the scheme lies between the range of hills stretching from Bristol to Clevedon on the one side and from Bristol as far as Yatton on the other, forming a roughly triangular basin. The area is below high-tide level and can be drained only when the tide is out.

Draining this part of North Somerset are four rivers with outlets to the sea but, with two emptying at the same place, there are actually five rivers in all. Much careful thought had to be given to the choice of a suitable route to the sea, and that eventually selected has been the subject of no little controversy. In view of the many queries and criticisms that have been raised on this subject and about the decision to cut an entirely new river rather than widen and deepen one of the existing rivers, it may be as well to give the principal reasons for the route chosen.

In the first place, the new river had a good outfall into the sea by way of a deep-water channel, instead of discharging through mud flats, which would have been the case farther down the coast. Had the old river been widened and deepened, there would have been danger of widespread slipping of the roads which follow it in places. Another point was the question of finding a route free from buildings.

One can appreciate the feelings of those farmers who have had to lose good land and suffered inconvenience through the new river crossing their farms—without, it may be mentioned, any real benefit to their own land—but the real point is the sacrifice of a small acreage of good land for the sake of

improving, or attempting to improve, a larger acreage of flooded land. Some people doubt the ultimate success of the scheme, believing that the drainage will cause these peat moors to sink. No one can be dogmatic enough to declare that this will definitely not occur, and even those who disagree with such a pessimistic outlook will nevertheless respect the views of those whose experience of moorland leads them to think that way. But for the sake of all concerned it is to be hoped that the pessimists are wrong: only time will answer this question.

The course of the new river lies through an area of fertile alluvial soil overlying a clay subsoil. Nearer the moors themselves are signs of an old sea-bed, and there is a theory that the River Avon once came down this side of the hills instead of through the Avon Gorge. Although the new river is cut through a formation of mainly blue clay subsoil, at one spot there is a mixture of shingle and gravel.

The New Blind Yeo is not designed to guarantee complete immunity from flooding, but it is expected to confine any serious flooding to December at the earliest and February at the latest, instead of being spread over the greater part of the year, as at present. The scheme should therefore give a much longer grazing season. Opinions have been expressed that flooding for short periods only will not do any harm, since the real damage is caused when the flood waters lie for weeks. In fact, I am told that on certain Somerset moors controlled flooding is a regular practice and found to be beneficial.

Nevertheless, it is to be hoped that the new river will prove even more effective than its designers believe, and that flooding will be entirely eliminated. The wise are always cautious, and so it should be with those responsible for a major scheme of land drainage. Although some may be tempted to write of such schemes and their results in a rather spectacular manner, those who know this country also know that improvement will inevitably be slow, steady and, it is sincerely hoped, sure.

Three Years in Construction For the past three years we have watched the draglines of the River Board biting into the clay and depositing it as great heaps of spoil along the route of the new river. During this time three road bridges have been built, as well as a railway bridge to carry the Clevedon-Yatton line. This last bridge was completed with a twenty-four hour continuous spell of work which included excavating the last remaining short stretch of the main river. Five accommodation bridges have been constructed where farms have been cut by the new river. Wherever a drinking place existed on a farm, a new one has been constructed or the farmer has been given the alternative of a piped water supply.

The actual course of the New Blind Yeo is from the sea at Clevedon Pill as far as Maynard's Bridge and, for a short distance, it has been found possible to make use of the old Blind Yeo by incorporating it into the new one. At Kenn Pier the river divides, one part being taken under the adjoining road to link up with the River Kenn and, through it, to take the drainage of the Yatton and Kenn Moors; the other part—a narrower version of the main channel—will continue for another two or three miles through the Tickenham Moors and so effect the improvement of this section. To permit the link-up between the new river and the River Kenn, a culvert 70 feet long with two openings 5 feet 6 inches by 5 feet, each fitted with penstocks, has been constructed at Kenn Pier. Another culvert 21 feet long with one opening 6 feet by 5 feet has also been built at Claverham Drove.

In addition to the main channel, existing waterways which have been, or are being, dredged include the River Kenn, Black Ditch, Clevedon and Tickenham Boundary Rhynes. The Clevedon Boundary Rhyne has been dredged and so has the Black Ditch. The others are now being started.

It may be of interest to give some details of the dredging of these channels. From the outfall to Manmoor Lane there is a fall of 1 in 5,000 with a bottom width of 10 feet and an average top width of 70 feet. The average depth along this stretch of 11,250 feet is 15 feet, and there is a 1 in 2 side slope. From Manmoor Lane to Kenn Pier—a distance of 1,330 feet—the average top width falls to 62 feet and the average depth to 13 feet. From there onwards to Maynard's Bridge the fall is 1 in 5,300 with a bottom width of 4 feet, an average top width of 40 feet and an average depth of 9 feet.

These particulars refer to the main channel. In connection with some of the subsidiary dredgings of existing channels or rhynes, it is interesting to note that the Clevedon Boundary Rhyne has been cut to a top width of 32 feet, with a depth of 7 feet, compared with its previous measurements of 12 feet and 3 feet respectively. The same original measurements apply to the Tickenham Boundary Rhyne, which will be increased to a width of 25 feet and depth of 7 feet. The Black Ditch has been cut to an average width of 24 feet and an average depth of 6 feet 6 inches.

The total excavation involved is nearly 350,000 cubic yards, and about 120 acres of land will have been purchased for the scheme. Not all of this will be taken up by the new river, for there will be something like 100 acres of spoil banks which will later become available for grazing. Consisting mainly of raw subsoil, these spoil banks will have to be weathered before they can be cultivated. At the moment the earliest sections of the banks have been subjected to certain cultivations designed to encourage the amelioration of the soil by time and weather. The method adopted was first to use a subsoiler several times to break the compacted banks. After each operation a period of two to four weeks was allowed before working the banks again. This initial preparation of the banks continued through one summer, and they were finally ploughed with a single-furrow deep-digging plough and allowed to lie for the winter. In addition to bringing up further clay for weathering, this deep ploughing also resulted in ploughing under most of the surface weed sands to a depth of about a foot so that they would not be brought up by future shallower ploughings. After the winter exposure the banks were subjected to a number of cultivations with an ordinary cultivator with the dual purpose of keeping down the weeds and contributing to a final weathered tilth. At the time of writing, the banks have to be cultivated again before being ploughed for the winter preparatory to seeding down in 1954.

There can be no short cut to success in the working of such virgin clay subsoil. Repeated cultivations and ploughings all exposed more clay to the weather and, spread over as long a period as possible, this appears to be the best way to tackle the task of converting such intractable material into useful grazing leys.

At the Pill outfall there is a specially constructed sluice consisting of a reinforced concrete-framed structure supported on reinforced concrete bearing piles. These piles also form anchorages to prevent the lighter parts of the structure floating when the sluice floor is dry. The machinery consists of two automatic tidal flaps 6 feet by 5 feet ; one emergency door 14 feet by 5 feet ; and one penning door 12 feet by 11 feet. The emergency door will

seal against both sea and land water if either the tidal flaps or the penning gate fail. The overall length of the structure is 150 feet, and the waterway is 12 feet wide. About 40 tons of steel and 23,000 cubic feet of concrete were used in the construction of the sluice by the Board's direct labour.

In all, there are ten bridges across the river, varying in length from 12 feet (at the outfall) to 86 feet. The road and railway bridges are of reinforced concrete, whilst the accommodation bridges are of steel with concrete decking. The road bridges are designed for Ministry of Transport loading.

Although this new river is of the gravitational type, a scheme based on pumping was also considered. Some people thought that this would prove the cheapest and best method, but it was rejected largely because pumping stations are highly rated. In addition, the cost of erection and maintenance would be high.

Improving the Newly-drained Land Having thus reviewed the main aspects of the scheme, it is opportune to take a look into the future and endeavour to form some idea as to the effect the improved drainage is likely to have on the farming of the land concerned. It will require time for the land to drain properly after the many miles of side ditches have been cleaned out, and so inevitably it will be many years before anything like a full picture of the improvements can be obtained.

Various views are held by farmers as to the most effective methods of improving these moors after the water has gone. In the fullness of time we shall doubtless witness the gradual improvement, but no one method will solve the problem since the geology at the moors varies considerably. Of the main forms of improvement, a minority suggest that ploughing and cropping under arable husbandry will produce high yields, and I have heard it said by experienced arable farmers that these moors would prove as fertile and productive as the Fens. However, I doubt whether very much of the land will come under an arable rotation in view of the fact that the whole area is in a dairy farming district. Also, from an arable aspect we have to consider the fact that whatever the moors of North Somerset may have in common with the Fen country, there is a much higher rainfall in the west than in East Anglia.

Another method of improvement likely to be adopted—after the more courageous have tried and proved it—is that of ploughing and reseeding. On a well-known Sedgemoor farm one of Somerset's leading farmers has been very successful in establishing first-class leys on peat. The technique has been to drill 10 lb. Danish meadow fescue and 1 bushel of oats per acre (the latter to encourage early stocking), to roll thoroughly with two ring rollers and then to broadcast a mixture of 6 lb. certified S.48 pasture-hay strain timothy to 1½ lb. certified S.100 white clover at the rate of 17½ lb. per acre on the rolling, afterwards rolling thoroughly again. The timothy and white clover must not be sown too deep. On such land, too, leys are never sown down without at least 6 cwt. per acre superphosphate or 8 cwt. per acre basic slag. Another successful mixture on peat for the dairy herd is 10 lb. Danish meadow fescue, 8 lb. certified S.48 timothy and 1½ lb. certified S.100 white clover, making a total sowing rate of 19½ lb. per acre.

A further example of the reclamation of wet peaty land which I have been privileged to inspect comes from Exmoor, where Earl Fortescue has effected tremendous improvement on a large acreage of peaty moorland over 1,000 feet above sea level and subjected to a high rainfall. One of the successful mixtures on this type of land consists of 12 lb. Irish perennial ryegrass, 10 lb.

Scottish timothy, 1 lb. rough-stalked meadow grass, 2 lb. Irish crested dogstail, 3 lb. Canadian alsike, 1 lb. certified wild white clover, 1 lb. rape and 1 lb. turnip, making a seed rate of 31 lb. per acre.

The fact that such mixtures and methods have succeeded in improving peaty moorland in other parts of Somerset does not, of course, automatically imply that they will effect the same transformation in North Somerset. Nevertheless, I feel that they offer a good chance of being successful, although only experience will prove the matter.

Another method, and one which will most likely appeal to a large number of farmers in the early years, is by means of surface improvement alone. This comprises liming, application of fertilizers—mainly phosphates—and surface treatment of the existing sward by mowing and severe harrowing or rotary cultivating to tear out the accumulated mat of dead growth. In some sections of the moor this method may prove to be the best since it will avoid breaking the turf. This latter consideration is important, for once you go through to the underlying peat, tractors and implements will very soon sink. My own tractors have suffered in this way, even in dry weather on apparently unbroken moorland. In fact, the only way in which it will be possible to improve some of this soft moorland will be with the help of crawler tractors with wide tracks.

The Future The official opening of the new river does not mean the end of work on the project ; much more has to be done, but at least the main waterway will be open to carry away the winter flood waters. It must also be pointed out that those farming the newly-drained areas have a responsibility both to the nation and to the River Board to ensure that once properly drained they carry out their part of the contract and see that no effort is spared to ensure the proper farming of the land.

Our flood problems can and will be overcome by men with vision and faith in the future and strength of British agriculture, and courage enough to resist the propaganda of those who preach the illusory policy of cheap food at any price and from every acre but our own. On May 11 the Minister of Agriculture, by opening up the New Blind Yeo, handed a lighted torch to those who farm such moorlands. May they, in their own and the nation's interest, be able to keep it burning and intensify its flame when the time comes to hand it to future farmer holders.

FARM PRODUCTIVITY IN PEMBROKESHIRE

TEN YEARS' ENDEAVOUR

W. H. JONES, O.B.E., M.Sc.
County Agricultural Officer

More food from less land has been achieved in Pembrokeshire during the past ten years ; and Mr. W. H. Jones sees a potential for yet further increases in this Welsh county of small farms.

IN the years between the two wars the farming industry in Pembrokeshire suffered many vicissitudes. Situated in the extreme west, it was far from the large food-consuming centres, and this made the marketing of many farm products both difficult and costly. During those years of general depression it was not surprising that some of the land, though inherently fertile, went out of cultivation, and that the number of agricultural workers fell from seven to four thousand. But with the call in 1939 for a sharp increase in the production of food, the farmers' response was both quick and substantial. As a result of those efforts, the position in the county today shows marked advances in many directions on the level of farming that obtained some ten years ago.

Productivity Lift During the decade under review, most of the old permanent pasture was ploughed and put through a rotation ; only those areas which are either too steep, stony, or wet escaped this treatment. The tillage area of 44,000 acres in 1939 was increased to 106,000 acres in 1943 and in recent years has become more or less stabilized at about double the pre-war figure. Also, more productive temporary leys have, over a large part of the county, replaced the permanent pastures.

The main cash crops are early potatoes, sugar beet, some grain and horticultural crops. The early potato industry, which has passed through a successful experimental stage between the wars, was rapidly developed since it was already manifest that certain parts of the county were particularly suitable for the production of very early crops. In reasonably favourable years planting in late February and early March enables lifting to start in late May and to be completed early in June. From 1,100 acres in 1939, the early potato acreage has expanded to over 7,000 acres in recent years. Early lifting enables double cropping to be practised ; some of the land carries a second crop, such as brassicas, but most of it is now devoted to fodder crops which are so valuable for winter stock feeding.

Nearly 80 per cent of the grain grown is home fed. The shortage of imported feedingstuffs during the war compelled farmers to place greater reliance on their own resources for winter feeding, and the present high level of self-sufficiency seems likely to remain a stable feature. The advantages of temporary leys, now increased by 74 per cent over the figure for 1939, are well appreciated.

Increasing interest is also shown in the conservation of grass. The quantity of silage made in 1939 was small, and production was confined to a very few farms ; in 1951 at least 25,000 tons were made, and the quantity is going up every year. Grass-drying plants have been set up at nine centres, and when better methods of processing are available still further progress is likely.

The cattle population of the county rose from 88,000 in 1942 to 103,000 in 1952—a very satisfactory increase of 17 per cent. This figure alone,

Land at Penbank, near Letterston, before reclamation by the Pembroke A.E.C. A good crop of rape for seed replaced this barren waste.

Schoolchildren lend a hand in reclaiming bracken-infested land at Haverfordwest for . . .

. . a good crop of early potatoes.

Cattle and sheep add their quota to greater productivity. First-calving Hereford breeding cows and . .

Photos: *Farmer and Stock-Breeder*

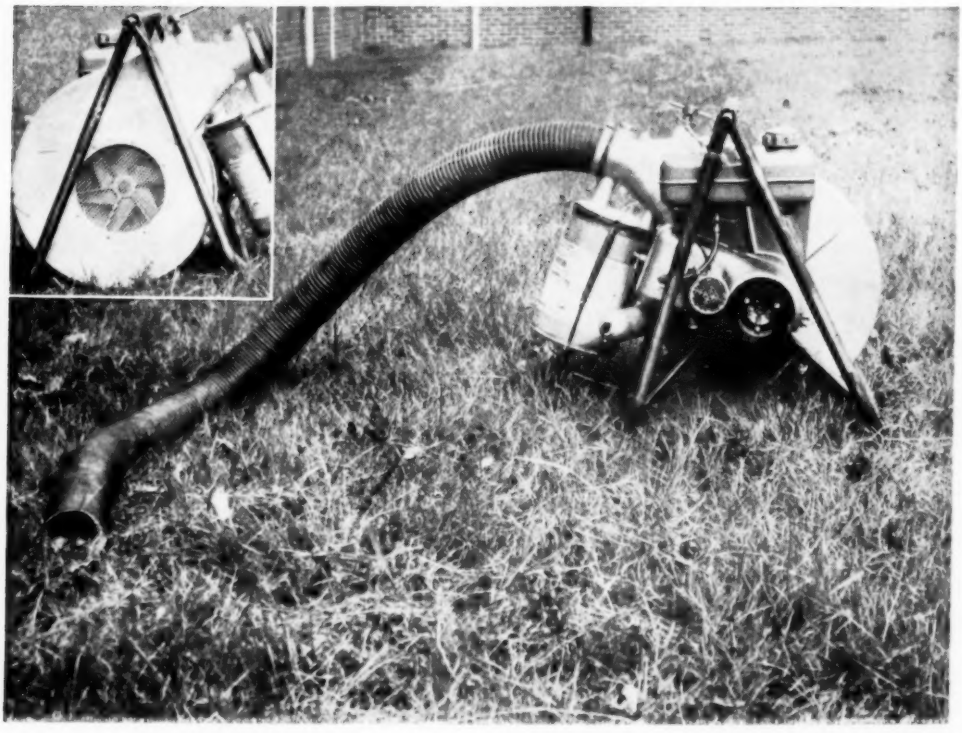
Clun × Oxford lambs on a Pembroke farm.

Time of Sowing Field Test, Cambridge, 1953 (*see p. 379*)

N.I.A.B.

1. Fylgia. 2. Atle. 3. Bersée. 4. Holdfast. 5. Squarehead's Master 13/4.
6. Cappelle Desprez. 7. Hybrid 46. 8. Staring 9 Pilot. 10. King II
Late-sown plots in front ; earlier-sown behind. Photograph taken August 5, 1953

POWER GASSING OF RABBITS (See pp. 383-6)



Prototype of petrol-driven fan impeller which has proved very successful in rabbit gassing. *Inset* : Reverse side of machine showing fan.

however, does not give a full indication of the position, for during this period dairy cattle rose by 21 per cent, and it is this class of stock that makes the heaviest demand upon food supplies. When all cattle are compared on a stock unit basis, the increase between 1942 and 1952 works out at 19 per cent.

Improvement in quality has also been very marked, particularly in herds where the breeding policies are sound and pure-bred stock has been acquired. Many breeders have won premier awards at the leading agricultural shows. Cattle from Pembrokeshire have recently realized high prices at pedigree sales and many have been exported. Considerable progress is also being made towards healthier herds. Part of the county is at present a Tuberculosis Eradication Area and the remainder a Free Testing Area. At present 59 per cent of the cattle are attested, and it is anticipated that in the near future the whole county will become, with those adjoining, a Clean Area.

Sales of milk have consistently increased and now, at over 23 million gallons per year, are some 2½ times higher than the 1939 figure. This has been achieved partly by the reduction in farm butter-making but more particularly by higher individual yields. The average at the moment is 650 gallons per cow—an average increase of 142 gallons since 1946. There has, too, been an increase of 38 per cent since 1949 in the number of herds officially milk recorded.

Although the milk industry has shown such an advance, meat production has by no means been neglected. During the war there was the inevitable fall in numbers of sheep, pigs and poultry, and the hill sheep flocks also suffered considerable losses in the 1947 blizzard. By 1952, however, substantial gains had been made; poultry and pig numbers had both exceeded the pre-war level.

Sales of fat stock to the Ministry of Food in two recent years were :

	Fat Cattle	Calves	Sheep	Pigs
1948	8,819	15,409	30,687	872
1951	12,896	16,121	31,826	5,317

By the gradual increase in the productivity of grass and arable land, improvement in quality and better management of stock, we expect the output of fat stock to continue to rise and milk sales to be maintained at about the present level. Many farmers are devising effective means of combining these two enterprises and thereby raising the output of food from their farms.

Resources and Equipment Expansion in the output of food is, of necessity, related to the area of land available and the quality of the permanent equipment. The loss of land to the Services during the war and to local authorities later has been appreciable. On the other hand, reclamation work of various kinds has to some extent offset this loss ; some 2,118 acres of marginal land have been brought into a more productive state, mainly by growth clearing, ploughing, cultivating and reseeding. But notwithstanding all this, the area now available for food production is estimated to be some 3½ per cent less than it was in 1939.

A county of high rainfall suffers continuous and heavy losses from the soil of minerals, particularly lime, and their replacement is most essential. The quantity of lime applied in recent years has been between twice and three times the average pre-war figure, and during the last seven years some 276,000 tons have been distributed. The heavy rainfall also creates the

problem of wet areas which need to be drained before they can efficiently make their contribution to the food production drive. Since the inception of the grant-aid schemes for drainage, the work has steadily proceeded, and by 1952 the following had been undertaken:

Land Drainage Work

Type of Drainage	No. of Schemes	Total Cost £	Benefit Acreage	Average Gross Cost per Acre £ s. d.
Arterial and ditch ..	1,267	135,858	9,821	13 14 6
Tile	528	25,119	2,019	12 9 0
	1,795	160,977	11,840	13 1 9

Much arterial work remains to be done, especially the cleaning of river beds and main leats, before the smaller ditch and tile schemes can be fully effective. New schemes are continuously being undertaken and land is being drained in the county at the rate of about 1,100 acres a year, whilst at the same time work on some of the older projects is being maintained.

With the change from stock rearing to milk production, came a greatly increased demand for better farm water supplies—water not only for drinking purposes in buildings, farmyards and fields, but also for cooling milk, washing byres and for many other purposes. In 1940 the County Agricultural Committee began the work of installing water on the farms, since many occupiers who wished to avail themselves of the grant-aid proposals were unable to do so owing to an acute shortage of contractors who would undertake this type of work. From 1940 to the present the following schemes have been approved:

No. of Schemes Undertaken	Acreage of Land Watered	Dairies Supplied	Total Cost	Average Gross Cost per Scheme
1,149	29,542	1,041	£237,075	£207

The installation of a regular and reliable supply of water on almost a third of the dairy farms of the county during this period can be claimed as a creditable achievement ; it certainly proved to be of great benefit to the milk producers concerned, enabling dairy stock to make better use of feedingstuffs and promoting the clean milk campaign.

The last decade has undoubtedly witnessed a greater change in farm mechanization than any other of recent times. Since 1939 the number of tractors has risen from about 300 to over 3,600 and the complement of farm machinery has been substantially increased ; this was to be expected, however, in view of the new source of motive power and the need of greater efficiency in the use of labour. This displacement of horses for farm operations was inevitable and a decline from 12,800 to 4,000 in the county during the period was in harmony with that occurring throughout the country generally. During the post-war years new equipment has been acquired for most farming operations ; milking machines have increased fourfold and combine harvesters, grain and grass drying units are being installed in increasing numbers. The provision of more drying and storage facilities for the use of the small farmer will, it is felt, prove to be a great incentive in maintaining the acreage under tillage, as the heavy losses suffered at harvest time owing to inclement weather are often very discouraging.

Labour Position The migration of people from the land between the wars left the agricultural industry in a difficult position to meet the demands made upon it in 1939. During the ten years under review the number of agricultural workers fell by 57 per cent, and many farm cottages were either in ruins or in a very bad state of repair. Schemes for supplementing the labour supply which functioned during the war and for some years afterwards were very helpful and at the maximum point served to increase the total labour complement by about 50 per cent. More recently casual workers from the towns and villages within the county have volunteered for seasonal work and an ample supply has been available to meet the peak demands at harvest time. Regular workers, however, have in general been rather scarce, and it has sometimes been difficult to fill vacancies, particularly of dairymen. The general position over the decade can be seen from the following table :

Farm Labour Strength

	Labour Units			
	1939	1942	1945	1952
Per 100 acres farmed land	2.9	3.2	3.3	3.3
„ acres tillage	20.0	8.3	10.1	11.5
„ dairy cows	20.1	20.0	19.7	18.0
„ livestock units	7.7	9.1	9.1	9.0

The labour strength on the farms in each of these four years is obtained by taking the total permanent workers and adding the number of casual workers, with an appropriate allowance for part-time employment. When these figures are related to the area of farmed land and the stock carried, a general comparison can be made. The overall position seemed to be slightly better in 1952 than in 1939 and has remained fairly level since 1942. The rapid mechanization of farming in recent years has, of course, resulted in greater output per person employed than was the case in the days of the horses.

Productivity Potential The last ten years have undoubtedly witnessed many changes and appreciable progress in the agricultural industry of Pembrokeshire. But the potentialities of the county are still considerable and, as further improvements to the land and its equipment become effective, food production could no doubt be stepped up, with no great difficulty, to the Minister's target of 60 per cent and more over the pre-war level. Many well-managed farms in the county have far exceeded this figure and, if up-to-date methods were more universally applied, the general target set could easily be surpassed.

The provision of an adequate supply of home-grown winter food for livestock is of paramount importance, and to attain this objective the maintenance of the tillage acreage at about 25 per cent of the farmed land, except in the exposed upland regions, appears to be necessary in future. The risks of severe losses of grain crops from inclement weather during harvesting can be reduced appreciably by greater use of grain drying facilities.

Further reliance, however, on fodder crops such as kale and rape rather than on grain may be advantageous. Some of the more productive farms allocate slightly over 10 per cent of the tillage land to these crops, as against about 4 per cent for the county as a whole.

Further use could undoubtedly be made of the pasture land. In some areas injurious weeds are much too conspicuous in the summer months and in consequence the growth of grass is seriously impaired. Cutting or

spraying with selective weed-killers and, when possible, heavier grazing with sheep, would gradually improve these pastures. On the lowlands under good management, including balanced manuring and rotational grazing, two acres of well-managed land can provide sufficient food for one cow for a year. On the average, however, even excluding the less fertile regions of the uplands, it takes just three acres today.

To keep abreast of scientific developments, farmers have always taken advantages of the advisory services available. Requests for advice on all aspects of food production have been made, covering the treatment of the land and the management of livestock. Some 9,500 samples of soil have been analysed during the last four years. Since the establishment of the National Agricultural Advisory Service, the assistance available has been increasingly appreciated, for it is realized that a combination of scientific principles and sound farming methods is essential if further progress is to be made in the drive for maximum food production for the nation.

SPRING SOWING OF WINTER CEREALS

C. S. Elliott, B.Sc., H. N. Greenwood, B.Sc., and B. C. R. Reiss, B.Sc
National Institute of Agricultural Botany, Cambridge

It is virtually impossible to give a definite date after which a particular cereal variety cannot safely be sown, because of the effect of season and locality. But tests carried out by the N.I.A.B. to examine the response of winter varieties to spring sowing permit a preliminary classification to be made.

THE best time to sow either winter or spring cereals is governed by many factors. It depends on locality, season, soil type and fertility, winter hardiness of the variety, and on the physiological response of a particular variety to the environmental conditions to which it is exposed. In some parts of the country it is common to sow winter varieties as early in the autumn as September, while in other areas sowing may be delayed, intentionally or otherwise, until perhaps December. There may be sound practical reasons for both of these extremes. In the case of spring corn, most drilling takes place during February or March, but in some districts, if weather and soil are suitable, spring sowing will begin in January. In other seasons persistently wet weather may delay spring sowing until April or even May. It will be seen, therefore, that the sowing of cereals may be taking place in this country at any time during the period from September to May. It is not intended here to discuss the best sowing date, but to seek an answer to a question which is often asked : " How late can a variety safely be sown ? "

The fact that there are winter and spring varieties has long been recognized, but it is not possible to draw an absolute line between these classes. A winter variety may be defined simply as one which is sufficiently hardy to withstand the winter of the district in which it is to be grown; and a spring variety one which, when sown in the spring, is capable of ripening early enough to allow satisfactory harvesting. Some winter varieties require to

be subjected to low temperature or short-day influences to grow and mature successfully ; this is not necessary for the true spring varieties. Between the extremes of the winter and spring types there are various intermediate forms. There are degrees of winter hardiness and there are variations in the latest date at which different varieties can be sown and expected to reach maturity. Some varieties will fit into both of these classes. When autumn-sown they can withstand the winter, and when spring-sown they will grow normally and ripen early enough to be harvested satisfactorily. It is difficult, therefore, to decide just where the division should be made between winter and spring varieties.

In the case of wheat the accepted division in this country has been made not so much on the degree of winter hardiness as on the basis of the suitability or otherwise for spring sowing. Most varieties of wheat—even the spring types—are sufficiently hardy to withstand normal English winters, but some may be severely damaged in a really hard season. In addition to the terms "winter" wheats and "spring" wheats, the French have for some time used the expression "alternative" varieties. Jonard* defines this term as follows : " A wheat is alternative when it can be sown either in the autumn or in the early spring, and when in the latter case it is capable of accomplishing its normal vegetative cycle". He classifies wheat varieties into five categories on the basis of the practical limits of safe sowing dates in the Paris region, using the terms "winter", "semi-winter", "semi-alternative", "alternative", and "spring".

With oats, the accepted division between British winter and spring varieties is based only on the degree of winter hardiness. All the winter oats can be sown in the spring and will produce a crop.

The number of winter barley varieties which are grown in this country is limited. It is not uncommon to sow spring varieties in the autumn, but these are not fully winter-hardy. Like oats, then, the division between winter and spring varieties has been made mainly on the basis of winter hardiness.

Field Tests For many years it has been the regular practice of the National Institute of Agricultural Botany to make successive spring sowings of all new varieties of wheat on the trial ground at Cambridge. These field plots have made it possible to give a general classification of all new varieties on the basis of their suitability for spring sowing. Since 1951 this work has been extended to provide fuller information from a wider geographical range. These Time of Sowing Field Tests have been conducted at a number of the regional trial centres of the N.I.A.B., and at N.A.A.S. centres, extending from Boghall, Edinburgh in the north to Seale-Hayne, Newton Abbot in the south-west. All the varieties named in the N.I.A.B. *Recommended List of Winter Wheats*, together with certain other widely-grown varieties, were included in these tests. The well-known spring wheats, Atle and Fylgia, acted as standards. The winter oats and barleys included in the N.I.A.B. recommended list were also tested. Very small plots were used and three successive sowings were made at each centre in each season at the following times : (*a*) mid-March, (*b*) end of March, (*c*) mid-April. The trials were examined at regular fortnightly intervals throughout the

*P. JONARD. *Les Blés Tendres Cultivés en France*, 1951, 113.

summer, and the stage of growth* of each variety was recorded.

The additional records obtained from these plots have confirmed the results of the previous tests—namely, that varieties can be classified on the basis of their suitability for late sowing—and they demonstrate the different course of phasic development between a genuine spring cereal, such as Fylgia, compared with a true winter hardy variety like Pilot (Fig. 1).

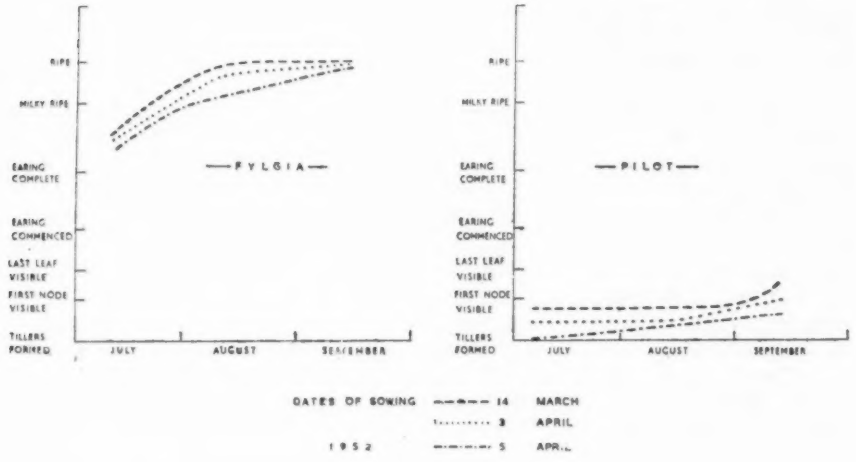


Fig. 1

Illustration of the stages of development of a true spring wheat (Fylgia) and a true winter wheat (Pilot) when sown in the spring (in southern England).

The results also serve to emphasize that it is not possible to state definite dates after which particular varieties cannot safely be sown because of the effects of season and locality.

Effect of Season and Locality The seasonal effect on some varieties was very distinct. Although sown on approximately the same date at the same place in each year, certain varieties behaved very differently from one year to another. For example, an extreme case occurred at Sprowston (Norfolk) with the variety Redman. Fig. 2 illustrates the growth stages of this variety at the same place in 1951 and 1952 respectively. In 1952 the plots, which were sown on April 15, remained in the grassy stage throughout the summer, but in 1951, when sown on practically the same date (April 17), Redman had come into ear by July 27 and was considered ripe by September 24.

The effect of locality may be very marked. Some varieties remain in the vegetative stage when sown in the spring in the southern part of the country, but when sown on the same date in the north, where temperature is lower and days longer, will successfully pass through all their growth stages and come to maturity. This is illustrated in Figs. 3A and 3B, which show the growth stages of Pilot in 1951 when sown on almost the same dates at Newton Abbot (Devon) and at Edinburgh.

* The scale of growth stages used was based on that given for wheat in W. FEEKES. *Versl. Tarwe Comm., Groningen, XVII*, 1941, 560, with additional notes and drawings by F. Earnshaw and E. C. Large respectively.

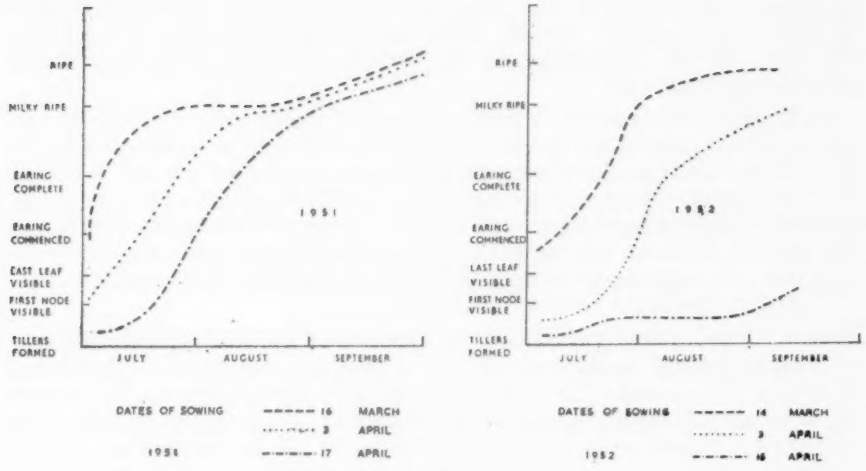


Fig. 2

Illustration of the seasonal effect on the stages of development of a wheat variety (Redman) when sown at the same place (Sprowston, Norfolk) in two successive seasons.

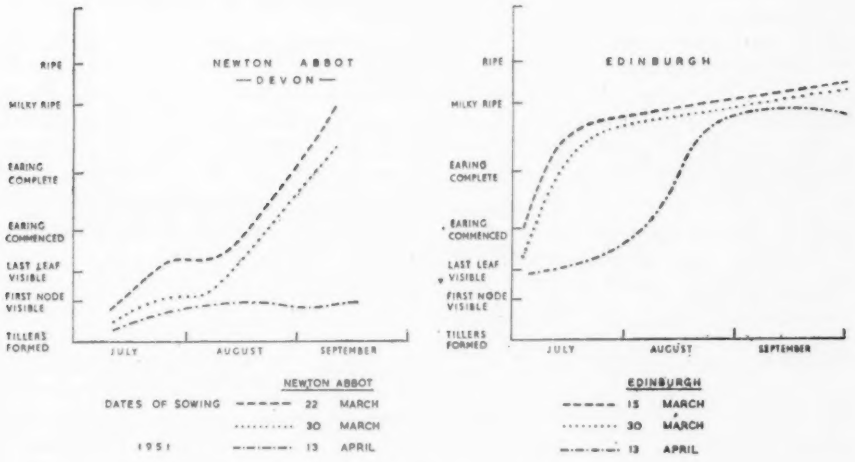


Fig. 3

Illustration of the locality effect on the stages of development of a wheat variety (Pilot) when sown at the same time in different areas.

Practical Recommendations The above illustrations make clear the difficulty of stating a definite date after which a particular variety cannot safely be sown, either over the country as a whole or even at a single place. Furthermore, the fact that a certain variety, if sown very late, can pass successfully through all its growth stages and reach maturity does not necessarily mean that it is a safe variety to grow, because ripening might be so delayed that it would be too late to harvest successfully. For example, Fig. 3B shows the growth stages of Pilot when sown late in the spring in Scotland. It will be seen that even when sown as late as April 13, it ultimately reached maturity, but this variety could not be recommended

as suitable for sowing at this time because it did not ripen until mid-October, which is too late to make harvesting a practical proposition. The same variety, when sown at the correct time in the previous autumn, was ripe by August 29.

Until more information is available on the temperature and day-length factors which control the growth cycle of the different varieties, only broad distinctions can be made between them. More detailed work on the response of winter wheat varieties to spring sowing is now in progress at Cambridge, at Winmarleigh in Lancashire, and at other centres. Meanwhile, the following general guidance can be given on the latest dates for sowing different varieties. It must be remembered, however, that the best results are not obtained by sowing at the last possible moment.

Wheat. The following is a list of the more widely-grown varieties of wheat in England placed in the order of their increasing suitability for late spring sowing. The varieties have also been classified into groups, but it must be stressed that there is no well-defined division between the groups. The last variety of one group will be very similar to the first variety of the next group.

King II Pilot Scandia Rivet Wilma Victor Juliana Staring	Varieties which are not recommended for sowing after the end of December and cannot be sown after the end of January without risk of unsatisfactory results.
Little Joss Steadfast Jubilégem Squarehead's Master 13/4 Squarehead II Holdfast Redman Warden Yeoman Cappelle Desprez Nord Desprez Vilmorin 27 Hybrid 46	Varieties which can normally be sown safely until mid-February and can be sown until the end of February without serious risk of failure.
Bersée Atle Meteor	Varieties suitable for sowing in March.
Fylgia April Bearded	Varieties which can be sown during April, although earlier sowing is recommended.

It will be seen from this grouping that there appears to be some evidence of a correlation between growth habit and suitability for late spring drilling. The list grades downwards from the extremely prostrate Scandinavian wheats through the prostrate English and Dutch types to the semi-erect French winter wheats and, finally, to the erect habit of the true spring wheats.

Oats. As already mentioned, all the winter varieties can be sown in the spring and will produce a crop, but spring varieties will usually give better results when sown at this time.

Barley. The variety Pioneer is a true winter barley and appears to require a stimulus due to low temperature or short days before it can reach maturity. For this reason it should be sown before mid-February, otherwise there

will be serious risk of the crop failing to come into ear, or of earing so unevenly as to produce a sample too variable in maturity to be suitable for malting. Prefect, however, although winter-hardy, is closer to the spring barleys and will reach maturity when sown a little later.

POWER GASSING OF RABBITS

HARRY V. THOMPSON and C. J. ARMOUR
Infestation Control Division, Ministry of Agriculture and Fisheries

The use of small petrol-driven machines for introducing cyanide gassing powders into rabbit warrens promises to accelerate rabbit destruction. Early tests with compressed air units have led to the development of a lighter and more efficient fan impeller.

FARMERS all over the world are becoming increasingly aware that the destructiveness of the rabbit to crops of all kinds far outweighs the value of its carcass. As part of the drive for increased food production, the Ministry of Agriculture and Fisheries, through the county agricultural executive committees, is stimulating planned rabbit destruction over large blocks of land, the clearance of rabbit-infested scrub, and the reclamation of marginal land and derelict woodland. While all methods of rabbit control (for example, trapping, dog and gun, ferreting, snaring, long netting, and the use of fencing and repellants) are advocated, the practice of cyanide gassing, when conditions are suitable, is strongly recommended as being at once humane and highly efficient.

The fumigant is normally used in the form of powdered cyanide compounds which, in contact with moist air, give off hydrocyanic acid gas. There are two methods of introducing the cyanide into the burrows—spooning and pumping. It is essential that all surface-living rabbits should be shot or dogged into burrows beforehand. The spooning method is more economical for small infestations or for dealing with a residue of rabbits surviving other methods of control. All rabbit holes should be blocked with earth and, after two or three days, about 1 oz. of powder (a level tablespoonful) should be laid in a small heap about six inches down every hole that the rabbits have reopened. Each hole should then be carefully blocked with a clod, turf side downwards. A lethal concentration of gas builds up for about two feet down the burrow and lasts for at least twenty-four hours ; rabbits seeking to dig their way out are overcome by it.

The pumping method is more economical for larger, well-populated warrens with many holes. The entire burrow system is filled with a lethal concentration of gas, and holes from which the powder emerges must be blocked with turf. No preliminary blocking of holes should be done, since holes not reopened by rabbits would create "dead-end" sections into which the cyanide powder would penetrate less readily. A hand-operated stirrup pump is in general use at present and is very effective for warrens of moderate size, but really large warrens, and even some of those with 50–100 holes, are beyond the capacity of the stirrup pump. This method also has the disadvantage that one man's labour is continually needed for pumping.

POWER GASSING OF RABBITS

Preliminary Tests with a Compressor The use of a petrol-driven pump has frequently been suggested, but it was not until 1950 that the first trials of what we now call power gassing were carried out by Mr. R. H. Hughes (Pests Officer, Caernarvonshire). He used a compressor similar to that used for pumping air into tractor tyres or for paint spraying. The compressor forces air at high pressure (about 80–150 lb. per square inch) but low capacity (that is, a flow of air of 5–15 cubic feet per minute) across the top of a gassing powder container or "gun" having an on-off trigger. A small amount of the passing air is used to agitate the powder, which is then picked up by the main stream and forced out through the nozzle. Various compressor units and guns were tested in different parts of the country and reported upon favourably by county pests officers. In August 1952, it was decided to pool the experience of the various officers, and a conference was held at Shrewsbury under the chairmanship of Dr. J. W. Evans (Deputy Chief Scientific Officer of the Infestation Control Division). Before the discussion, different compressors and guns were tested on a 120-foot artificial rabbit burrow system constructed of 4-inch diameter pipes buried in the ground and cemented together.

It was clear from the conference that all the compressors and guns used had given some measure of satisfaction, and that power gassing enabled difficult infestations, such as those in sand dunes, chalk, gravel and heathland, to be dealt with effectively. Further development and some standardization were, however, necessary, and various problems, such as the most suitable degree of fineness of cyanide powders, the extent to which the powders were deposited at intersections of rabbit burrows and the degree to which they penetrated dead-ends, needed investigation. It was suggested (very fruitfully as it turned out) that greater economy and a better distribution of powder might result from the use of a large volume of air at low pressure in an impeller, rather than a small volume of air at high pressure in a compressor.

Further tests were carried out with compressors, and difficulty was found in obtaining one that was both light and sufficiently powerful. A small compressor (weighing 56 lb.) without an air receiver, was unable to maintain a sufficiently high working pressure, whereas a heavier compressor, fitted with an air receiver, maintained the pressure but proved very awkward to move over rough ground. This difficulty could partly be overcome by the use of several hundred feet of hose between the compressor and the gun, but the hose itself is cumbersome. Moreover, accidents are likely to happen with the gun. When the compressed air blows through the gun, the air expands and moisture is deposited, particularly in the nozzle. The cyanide powder then cakes within the nozzle, so that after a time (the exact period depends on the atmospheric humidity) the nozzle becomes completely blocked. In this condition, pressure is built up inside the gun and bursts have occurred. Although this hazard can be eliminated by the use of a moisture trap and a very robust gun, kept scrupulously clean, there is still an element of danger under normal working conditions.

Promising Results with Impeller Comparative tests were done with compressors and a portable petrol-driven fan impeller normally used for insecticidal drift-spraying. Results with the impeller were so promising that a prototype model was made specifically for rabbit gassing. After six months' experiments and modifications, the following specification was evolved. A 75 c.c. petrol engine drives an 11-inch diameter paddle-type fan which delivers up to 150 cubic feet of air a minute

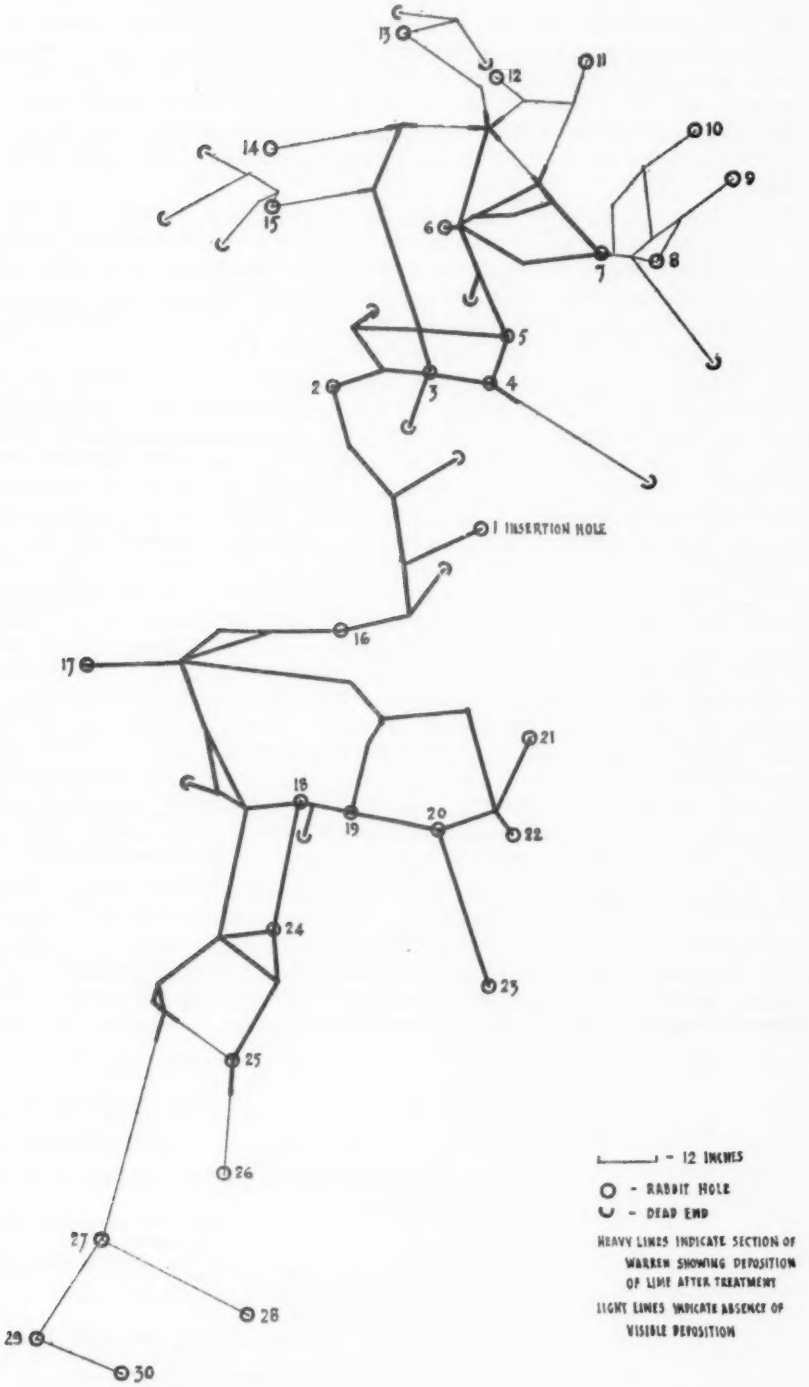


Diagram of rabbit warren experimentally "gassed" with slaked lime, showing extent of penetration.

at low pressure. An air stream from the fan agitates the cyanide powder in a 7 lb. tin, clamped to the machine, and feeds it into an outlet hose 3 inches in diameter and 6 feet long. It is not possible to use a longer hose without losing too much air volume, but since the machine weighs only 45 lb., it can easily be carried to any site. Both the air inlet of the fan and that of the air stream agitating the cyanide powder can be shut, so that the engine may be left running and the delivery hose removed from a rabbit hole without risk to the operator.

Only fine cyanide powder is suitable for use with the impeller ; but the large volume of air carries it throughout the rabbit burrow without piling it up at intersections. In the many tests which have been done with the impeller the consumption of fuel (petrol and oil) has averaged one quart per hour and that of cyanide powder 2–3 lb. per hour. In terms of rabbit holes, the consumption of powder has been slightly under $\frac{2}{3}$ oz. per hole.

Since cyanide powders are soluble, and because only relatively small amounts are pumped into the rabbit warren, a deposit is seldom seen on the walls of the burrow, even when the burrow is excavated immediately after gassing. The addition of dye to the powders did not make the deposits any more visible. A warren system containing 30 holes was therefore selected and experimentally "gassed" with slaked lime, which has much the same density as cyanide powders but is finer, non-toxic and relatively insoluble. The delivery hose of the impeller was inserted in one hole only, and lime appeared at all the remaining holes within six minutes. The treatment was continued for a further seventeen minutes after the blocking of the last hole to ensure a good deposit of lime. In all, 4 lb. of lime was used, that is, two or three times as much powder as would normally be required. The warren was excavated and its volume calculated to be approximately 75 cubic feet ; the length of the burrow system was 383 feet. Forty-six cubic feet of the warren and 233 feet of its length showed a deposit of lime. Although powder was blown out of every one of the 30 holes, at only 17 were deposits visible and, of the 14 dead-ends, 7 showed a lime deposit (see diagram). There can be little doubt that, had cyanide powder been used in place of lime, the whole of the warren would have been filled with a toxic concentration.

The hole into which the delivery hose was inserted led to a burrow which was found to meet another burrow in a T-junction after four feet. There was a heavy coating of lime at this junction but no piling up of the powder. Further tests are being done with the impeller, and chemical estimations of hydrogen cyanide concentrations in warrens after gassing are being made. A standard model of the machine will soon be on sale.

AGRICULTURAL STATISTICS
ENGLAND AND WALES

June 1952, Agriculture Returns (Final)

CROPS AND GRASS
(*thousand acres*)

DESCRIPTION	1939	1951	1952
Wheat	1,683	2,060	1,963
Barley	910	1,733	2,076
Oats	1,358	1,642	1,676
Mixed corn	83	826	827
Rye, for threshing	(b)	51	53
Beans, for stock-feeding	133	103	121
Peas, for stock-feeding	37	32	30
Potatoes, first earlies	56	137	121
Potatoes, main crop and second earlies	398	595	561
Total potatoes	**454**	**732**	**682**
Turnips and swedes for stock-feeding	396(c)	306	306
Sugar beet (for sugar)	337	415	398
Fodder beet (all kinds of high dry matter content)	(b)	(b)	69
Mangolds	210	255	216
Rape	53	133	140
Cabbage, kale, savoys and kohl rabi, for stock-feeding	94	247	250
Vetches or tares	49	30	27
Mustard, for seed, fodder or ploughing in	48	59	42
Linseed	4	27	17
Flax, for fibre		23	15
Hops	19	22	22
Orchards with crops, fallow, or grass below the trees	236	263	265
Orchards with small fruit below the trees	18	13	13
Small fruit, not under orchard trees	29	35	32
Vegetables for human consumption (excluding potatoes), crops under glass, and flowers	275	432	435
Fruit and vegetables, not grown primarily for sale	(b)	9	10
All other crops	48	41	27
Bare fallow	355	377	298
Lucerne	32	84	106
Temporary grass (including clover and sainfoin) for mowing	1,304	2,324	2,309
Temporary grass (including clover and sainfoin) for grazing	768	1,407	1,367
Total temporary grass	**2,072**	**3,731**	**3,676**
TOTAL ARABLE LAND	**8,935**	**13,680**	**13,792**
Permanent grass for mowing	4,612	2,827	2,924
Permanent grass for grazing	11,097	7,959	7,776
Total permanent grass	**15,709**	**10,786**	**10,700**
TOTAL ACREAGE OF CROPS AND GRASS (a)	**24,643**	**24,466**	**24,492**
Rough grazings—sole right	4,179	3,939	3,890
,, ,, —common	1,361	1,504	1,504(d)
Total rough grazings	**5,541**	**5,443**	**5,394**

(a) Excludes rough grazings.
(b) Not separately returned.
(c) Includes turnips and swedes for human consumption.
(d) Provisional.

SMALL FRUIT, VEGETABLES, CROPS UNDER GLASS, AND FLOWERS

(*thousand acres*)

DESCRIPTION	1939	1951	1952
Strawberries	18.7	17.5	16.0
Raspberries	4.1	4.3	4.3
Currants, black	10.4	15.9	15.0
Currants, red and white	2.3	1.6	1.4
Gooseberries	9.1	7.0	7.1
Loganberries and cultivated blackberries	2.5	1.2	1.2
Total small fruit	**47.2**	**47.6**	**44.9**
Brussels sprouts	38.0	40.6	45.5
Remaining spring cabbage (planted in previous year)	44.1	13.4	8.9
Summer cabbage		9.8	7.7
Autumn cabbage		6.0	5.2
Winter cabbage		13.2	12.9
Autumn savoys		3.7	3.5
Winter savoys		10.4	9.4
Kale and sprouting broccoli		2.2	2.0
Cauliflower or broccoli (heading)	18.9	23.8	21.7
Carrots	16.1	24.2	27.3
Parsnips	(a)	3.5	3.4
Turnips and swedes	(b)	6.0	5.6
Beetroot	(a)	7.4	8.9
Onions, grown for salad	1.7	1.2	1.3
Onions, for harvesting dry		3.6	4.1
Beans, broad	17.8	3.9	5.1
Beans, runner and French		8.5	8.1
Peas, green for market	60.6	40.3	39.1
Peas, green for canning or quick freezing	28.0	23.1	26.3
Peas, harvested dry		117.5	122.6
Asparagus	2.6	1.8	1.7
Celery	6.7	4.2	4.1
Lettuce	5.9	8.2	6.5
Rhubarb	7.2	9.0	7.8
Tomatoes (growing in the open)	0.2	1.7	1.7
Other vegetables	(a)	16.3	15.2
Total vegetables for human consumption (excluding potatoes) grown in the open	**247.7**	**403.5**	**405.7**
All crops grown under glass	**3.3**	**4.6**	**4.6**
Hardy nursery stock	10.5	10.4	10.7
All bulb flowers, not under glass	7.7	6.2	6.7
Other flowers, not under glass	5.8	7.3	7.2
Total flowers grown in the open	**24.0**	**24.0**	**24.6**

(a) Not returned.
(b) Not separately returned; included with turnips and swedes for stockfeeding.

LIVESTOCK

(*thousands*)

DESCRIPTION	1939	1951	1952
Cows and heifers in milk	2,255	2,370	2,372
Cows in calf but not in milk	392	490	464
Total dairy cows	**2,646**	**2,860**	**2,835**
Heifers in calf, with first calf	459	655	696
Total dairy cattle	**3,105**	**3,516**	**3,531**
Bulls for service	91	89	82
Bulls (incl. bull calves) being reared for service	43	34	31

LIVESTOCK (*thousands*) cont.

DESCRIPTION	1939	1951	1952
Other cattle two years old and over :			
Male (steers)	(a)	520	553
Female	(a)	709	665
Total	**944**	**1,230**	**1,218**
Other cattle one year old and under two :			
Male (steers)	(a)	446	424
Female	(a)	1,061	957
Total	**1,346**	**1,507**	**1,381**
Other cattle under one year old (excluding bull calves being reared for service) :			
Male (steers)	(a)	447	441
Female	(a)	1,091	1,042
Total	**1,242**	**1,538**	**1,483**
TOTAL CATTLE	**6,770**	**7,912**	**7,727**
Sheep one year old and over :			
Ewes for breeding	7,160	4,759	5,081
Two-tooth (shearling) ewes	1,477	1,226	1,203
Rams for service	205	134	140
Other sheep one year old and over	1,021	1,282	1,334
Total one year old and over	**9,863**	**7,401**	**7,758**
Sheep under one year old :			
Ram lambs for service	156	68	65
Other sheep and lambs	7,967	4,984	5,764
Total under one year old	**8,123**	**5,052**	**5,829**
TOTAL SHEEP AND LAMBS	**17,986**	**12,453**	**13,586**
Sows in pig	(a)	200	232
Gilts in pig	(a)	127	90
Other sows for breeding	(a)	123	145
Total sows for breeding	**449**	**450**	**467**
Barren sows for fattening	(a)	14	20
Boars for service	30	25	27
Young boars being reared for service	(a)	11(11.1)	10(9.7)
All other pigs :			
Five months old and over	633	708	1005
Two to five months old	1,516	1,047	1,437
Under two months	888	712	875
Total all other pigs	**3,036**	**2,468**	**3,316**
TOTAL PIGS	**3,515**	**2,967**	**3,840**
Fowls :			
Six months old and over	23,154	28,622	27,804
Under six months old	29,758	34,863	37,256
Total fowls	**52,912**	**63,484**	**65,060**
Ducks	**2,237**	**1,760**	**1,903**
Geese	**584**	**606**	**635**
Turkeys	**693**	**734**	**944**
TOTAL POULTRY	**56,426**(b)	**66,585**	**68,543**

(a) Not separately returned.

(b) As a result of war-time controls many small-sized holdings were recorded for the first time in 1941. It is estimated that to make the totals prior to 1941 reasonably comparable with later years some 3 to 4 million birds should be added in England and Wales.

LIVESTOCK (*thousands*) contd.

DESCRIPTION	1939	1951	1952
Horses used for agricultural purposes :			
Mares (including those kept for breeding)	347	146	125
Geldings	202	102	85
Unbroken horses of one year old and over :			
Light	110	16	13
Heavy		9	6
Horses under one year old :			
Light	15	6	5
Heavy	35	3	3
Stallions being used for service :			
Light	5(4.6)	1(0.9)	1(0.8)
Heavy		1(0.6)	–(0.4)
All other horses (not entered above)	132	82	78
TOTAL HORSES	**846**	**365**	**316**

LABOUR
(*thousands*)

DESCRIPTION	1939	1951(a)	1952 (a)
Regular workers :			
Male, 65 years old and over	375.3	24.7	24.7
,, 21 years old and under 65		393.2	382.0
,, 18 years old and under 21	44.7	48.4	38.6
,, under 18 years old	50.8	43.1	42.7
Total male	**470.8**	**509.5**	**488.1**
Women and girls	40.3	44.3	45.6
Total male and female	**511.1**	**553.8**	**533.7**
Casual workers :			
Male, 21 years and over	57.4	92.3	95.6
,, under 21 years old	5.9	10.2	10.6
Total male	**63.3**	**102.5**	**106.2**
Women and girls	32.7	51.8	62.0
Total male and female	**96.0**	**154.3**	**168.2**
Total male workers	**534.1**	**612.0**	**594.2**
Total female workers	**73.0**	**96.1**	**107.7**
TOTAL WORKERS	**607.1**	**708.1**	**701.9**

(a) Revised and more comprehensive instructions on the labour section of the form introduced for the first time in September 1948 resulted in the return of additional workers. The figures for 1951 and 1952 are not, therefore, comparable with those for 1939.

FARMING AFFAIRS

Men and Machines To mechanize or not to mechanize; that briefly was the question under discussion by industrialists and farmers at the conference on Management and Mechanization which was held in London on September 30 under the auspices of the Association of Agriculture and the British Institute of Management. The great stimulus which the war gave to the mechanization of British agriculture has transformed our farms out of knowledge, and only now are we beginning to feel the need to get the new farming picture into proper perspective—a need for research in farm management, more data on which to judge effectively how much and what kind of mechanization will give us balance in our systems of farming and increase productivity per man without introducing monotony and a sense of automatism in the farm worker.

MR. ARTHUR RICKWOOD, who farms on a large scale on the sand and flints of Cambridgeshire, was concerned about the possible effects that increasing mechanization might have on the minds of people employed in agriculture and also on those of parents of the rising generation who might see in present-day farming less skill, less craftsmanship and less scope for initiative and enterprise than has traditionally been associated with it. He entered a plea for future farm training to comprehend both brain and brawn and for a farming ladder that will allow versatility of jobs on the farm with incentive to rise to the more responsible positions.

This human problem was also explored by MR. B. UNGERSON, the Director of Personnel, John Lewis Partnership Ltd., who, as an experienced psychologist, made the point that the workers' fear of mechanization, where it exists, is understandable if the management presents them with a *fait accompli* instead of taking them into their full confidence. "If possible," he said, "we should get the workers to appreciate the economic circumstances behind the need. Let them participate in proposed changes."

MR. B. G. L. JACKMAN, Works Director of the Phoenix Glass Co. Ltd., underlined this theme by stressing the importance of capturing the workers' confidence and interest in the work they are called upon to do and the new techniques that it may be desirable to introduce into it.

The latter points have a pertinent reference to farming as well as industrial enterprise, although the considerations are not identical. Indeed there are marked differences; for example, farm mechanization is not designed to increase output in the sense that the industrialist understands it—that is, of producing more units in a shorter time—but rather the speed and efficiency of an operation and releasing men for other and more productive work on the farm. It has to be remembered, also, that unlike the factory, the farm doesn't call for the constant use of any one machine; the season governs the operation, and at other times the machine is, of necessity, "out of production". Hence the farmer's capital outlay is extensive; the manufacturer's intensive. The opinion was expressed, however, that perhaps our farms could with advantage become more specialized than they are at the moment. With fewer enterprises within the boundary of a single farm, mechanization need not be so heavy.

We have to consider, too, the size of farms. The vast majority of holdings in this country are under 200 acres, and obviously the small farmer must avoid over-capitalization. Small farms have small staffs, and so the common trend is against specialization of work in favour of getting workers willing and capable of tackling all jobs as they come up.

MR. JOHN ROWSELL, however, who farms near Winchester with a staff of thirty, favours specialization and making certain key people fully responsible in their own departments. "Specialization and mechanization," he said, "should go hand in hand. I believe that the only way to achieve cheap maximum production lies in a system which I like to refer to as 'mixed specialization'." But he conceded that our farms are not really large enough to allow for a development of this sort.

MR. A. N. DUCKHAM, of the Ministry of Agriculture, suggested that modern farming is calling up increased problems of management, and therefore we need to have more records of what we are doing and more facts and figures about the economics of mechanization. Can we not, he asked, lessen management worries by getting more contract services for farmers and by making purely physical jobs simple and foolproof?

SIR WALTER MONCKTON, Minister of Labour and National Service, speaking at the luncheon, crystallized the subject under discussion when he said, "We must all be concerned in using manpower today more efficiently. Mechanization releases manpower for other jobs: it can reduce fatigue in the manual handling of goods and so promote more regular and continuous production. Properly used, it should raise the standards of health among industrial workers and promote efficiency. It is essential to secure that the skill and experience of everyone is used to the best advantage . . . If there is one thing more important than all others today it is that we should be receptive to new ideas in management as well as in production. Indeed management must work harder at the job of managing. Let's face the fact that in some ways we were spoilt by the lead which we won in the decades following the industrial revolution. But that tremendous lead and the vast investment which we were able to make abroad have largely disappeared. Now is the time to make the fullest use of our inventive genius, to ensure that the lessons learned in the universities and the laboratories are applied throughout our industry and our agriculture."

S.R.O'H.

Wise Stock Feeding: 9. Kale for Protein Cattle, calves, sheep and pigs all respond well to kale. Called "the crop that fills the milk pail", it is particularly valuable for dairy cows. It is usual to grow marrowstem kale for use before Christmas and thousandhead kale for feeding in the New Year. This is because in a normal season marrowstem kale does not withstand frost long after Christmas. Many of the leaves break off and rot, and if the stems are bent they too may rot. Thousandhead kale is much more resistant to frost, partly because of its bushy habit. Some farmers prefer to grow modified varieties of thousandhead kale (such as Canson) for use in the New Year. These have properties intermediate in type between marrowstem and thousandhead but they tend to vary a good deal.

If kale is sown in rows, the crop may be cut and carted when required, in which case it is better singled. Alternatively, it may be grazed with the aid of an electric fence, when it may either be singled or, if the field is clean, sown very thinly and left unsingled.

On suitable soils and in certain areas, strip-grazing on unsingled or broadcast kale, using an electric fence, is by far the cheapest way of growing and utilizing the crop. It is best to allow the cow to graze the kale *behind* the electric fence. This is done by setting the fence high and just in front of the kale to be grazed, so that the cow can just reach one row underneath it. To avoid having to move the fence too often, the field should have a long "face".

In this way, little of the kale is wasted. If, however, the kale is to be grazed in *front* of the fence, it is advisable to sow a row of swedes or plant a row of cabbages at intervals to allow the fence to be moved. Generally, cattle can graze kale which has frost on the leaves (frozen kale) without ill-effect, but they should not be fed kale which has been damaged by frost (frosted kale). To avoid the risk of bloat, care should also be taken to feed some hay before cows are folded on kale, although too much hay should not be given, since kale is a comparatively fibrous food. In any case it is essential that cows should be introduced to kale very gradually.

A good crop of kale will normally yield 20 tons per acre, but up to 30 tons is possible. With a 20 ton crop, the yield per yard of drill (assuming 28-inch spacing between the drills) will be about 7 lb. Similarly, a square yard of kale sown broadcast and yielding 20 tons per acre will provide approx. 9 lb. of kale. A cow folding kale can usually eat 30–40 lb. in an hour.

Experiments in Northumberland indicate that if "Nitro-Chalk" is put on at singling time the protein content will be increased. The following rations, based on feeding 30 and 60 lb. of kale per day and taking into account this increase in protein, are suitable for 9 cwt. cows of ordinary type yielding up to 5 gallons of milk per day.

Ration	Kale not Fertilized with Nitrogen at Singling Time		Kale Fertilized with 4 cwt. per acre "Nitro-Chalk" at Singling Time	
	M + 1½ gal.	M + 2½ gal.	M + 2 gal.	M + 3½ gal.
	lb.	*lb.*	*lb.*	*lb.*
Kale	30	60	30	60
Good hay	15	12	15	12
Mineralized oats or other cereal	2½	4	4½	8

If the hay fed is only of medium quality, the above rations should be regarded as giving ½ gallon less milk than indicated. For heavier cows, add 1½ lb. hay for each hundredweight of live weight over 9 cwt. In practice, as much as 80–100 lb. of kale is sometimes fed to a dairy cow in a day, but 30–60 lb. is a more normal and desirable amount to feed.

For beef cattle a ration of 60 lb. of good hay per day, with oat straw *ad lib.*, should give a daily liveweight gain of 1¼–1½ lb. This gain could be raised to 2–2¼ lb. live weight per day by replacing the hay with crushed oats. Sheep can be folded on kale in the same way as on rape, but in this case the kale is usually sown in rows and left unsingled, or sown broadcast—often with some turnip or rape seed added. Pigs relish kale, but fattening pigs should not be given much more than 8 lb. of fresh kale. Sows may receive up to 20 lb. Generally, 8 lb. of fresh kale will replace 1 lb. of pig meal. It is important to remember, however, that for pigs the kale should be fed chopped. Poultry also are very fond of kale, especially the leaves. The kale can be hung up in bunches, heads down, and the birds allowed to pull at it at will.

N. Trinder

Farming Cameo : 35. South Oxfordshire

This area of Oxfordshire includes the rural districts of Bullingdon and Henley, embraces approximately 120,000 acres, and has about 1,200 holdings of more than one acre in extent. It is bounded in the west and south, and in the east from Reading to Henley, by the River Thames. From Henley to Thame the boundary is the Buckinghamshire border.

Soils vary considerably from the stiff clays around Oxford to the thin gravels of the Reading Beds in the south, the two districts being divided by the chalk formation of the Chiltern Hills, which rise to 800 feet near Stokenchurch, on the main Oxford-London road. Between 500 and 800 feet there are large areas of clay with flints, usually farmed intensively and capable of showing good returns in the form of milk, corn and/or stock. Farther south, the chalk is overlaid by formations of Plateau Gravel, which are inherently infertile and burn up quickly in dry spells.

The Henley district is mainly devoted to dairying, and the management of practically every farm where milk is produced is based on a ley system. There are some exceptions in the western part of this district, mainly on the large arable downland farms, where barley growing is the main enterprise. It is interesting to note that practically all the farms in the Henley district are connected to a mains water supply : ditches are almost unknown. Beechwoods, commons and residential properties are features of the countryside, and many of the farms are split into scattered fields with consequent management difficulties.

In the Bullingdon district the clays predominate and farming centres largely around arable crops, together with considerable areas of good leys and pasture land. The three clays, Gault, Kimmeridge and Oxford, run in parallel bands from the Chilterns to the north of the district. Arising as islands from the Kimmeridge are the villages of Horspath, Cuddesdon, Garsington and the Miltons, which are situated on the Portland Beds and mainly devoted to market-garden crops to meet the demands of Oxford. In these and adjoining villages there is considerable urban intrusion, and requests for the release of agricultural land to house the industrial workers from the Cowley factories are continually being made. The nearness of these factories makes the labour position around Oxford a most difficult one, although in some instances there has been a trend from the factory to the farm.

Two of the chief limiting factors to improved husbandry in the Bullingdon district are poor drainage and, in many cases, inadequate water supplies. The River Thame, which joins the Thames at Dorchester, drains most of the district, but in spite of the many comprehensive schemes which have been undertaken since 1939, much work remains to be done on drainage. Most farms rely on deep boreholes for their water supply, and in areas where adequate supplies are available many farmers have turned from beef to milk and a ley system of farming.

The Channel Island and Ayrshire breeds predominate in the Henley district, but Shorthorns and Friesians are more popular in Bullingdon, where some of the stock are bred to a beef bull. Sheep, which have steadily increased in number in the past four years, consist mainly of grass flocks, as the Clun Forest and Half-bred, together with Kent or Romney Marsh lambs which are bought in during the early autumn for stubble grazing, etc., and are sold the following spring. Great interest has been shown in stepping up the numbers of pigs and poultry in the area as a whole, and on many farms these two enterprises are proving valuable additions to a mixed farming practice.

D. H. Cameron,
District Advisory Officer

East Coast Sea Defences Soon after the east coast flood disaster on the night of January 31, the Minister of Agriculture set September 30 as the date by which the damaged sea defences should be rebuilt. It was an immense task ; but throughout the spring and summer work has gone ahead without respite, and restoration in all areas was virtually complete by that date. So far as can be assessed, the new defences will be as strong as, and in many places far stronger than, before the flood.

There is still some "finishing-off" to be done ; and to allow for this the Government has extended until December 31 the period within which the cost of restoration work will be fully reimbursed.

The damage done last winter extended to over 1,000 miles of coastline and involved some 1,200 breaches in the defences. The successful restoration of these defences before the autumn is a major achievement of which the river boards and their staffs, the contracting firms, and all others concerned may be justifiably proud. The Minister of Agriculture is deeply appreciative of their unremitting efforts and the spirit of public service which they have displayed : his views will undoubtedly be shared by the country as a whole.

From College to Career What happens to our agricultural students when, qualified by university degree or diploma, they leave college to enter one of the fields of the agricultural industry ? The following details concerning students* who left the University College of Wales, Aberystwyth during the six years 1947–52 provide an interesting commentary on that question.

	Degree		Diploma in Dairying		
	245		113		
	Men	*Women*	*Men*	*Women*	*Total*
Ministry of Agriculture and Fisheries					
1. N.A.A.S. and Agricultural Economics Advisory Service	28	1	6	11	46
2. Agricultural Land Service	6	—	—	—	6
3. National Milk Testing Service					
(*a*) Asst. area supervisors	—	—	6	5	11
(*b*) Milk sampler testers	—	—	3	6	9
4. Others	4	—	—	—	4
Lecturing, Teaching, etc.					
5. Universities	14	2	—	—	16
6. Farm Institutes	17	—	2	4	23
7. Schools	9	3	1	—	13
8. County agricultural education organizers	2	—	—	—	2
Other Careers					
9. Farming	35	2	11	24	72
10. Research posts	35	3	—	—	38
11. (*a*) Post-graduate research†	11(29)	2(3)	—	—	13(32)
(*b*) Post-graduate training†	7(23)	1(2)	—	—	8(25)
12. Colonial agricultural service and Dominions	21	—	—	—	21
13. Posts with commercial firms	20	1	8	1	30
14. Laboratory and creamery assistants	—	—	5	16	21
15. Miscellaneous	9	5	—	2	16
16. National Service	7	—	2	—	9
	225	20	44	69	358

* The men were ex-service or had, in the main, completed their National Service.

† See note 11.

Degree students have taken either honours (in Animal or Crop Husbandry, Agricultural Botany, Chemistry with Agricultural Chemistry, Economics with Agricultural Economics, or Zoology with Agricultural Zoology), or pass degrees. Fifty-seven diploma students obtained College and/or National Diplomas in Dairying, while fifty-six failed to do so, or did not attain the standard required for admission to second-year work.

Pass degree students without a strong practical background may find considerable difficulty in obtaining posts. Generally—and this applies particularly to women—they should consider post-graduate training in, for example, Bacteriology, Dairying, Agricultural Engineering, Poultry Husbandry, or undergo professional training for teaching. Men and women students of Dairying have little difficulty in obtaining posts.

The following notes provide further information about categories 1–16 in the table overleaf :

1. Specialists included 7 nutrition and soil chemists, 5 economists, 4 entomologists and 2 plant pathologists: all were honours students. The remaining eleven, comprising 10 advisory officers and a technical assistant on an Experimental Husbandry Farm, were mainly pass degree students. The seventeen Dairy Diploma students included 5 men and 10 women Milk Production Officers and 2 laboratory assistants.

2. The students who entered the Agricultural Land Service as assistants in the non-professional class have worked with Land Agents of County Agricultural Executive Committees. On passing an appropriate professional examination, they are eligible to compete in the Civil Service competition for established Land Officer posts in the professional class.

3. Assistant Area Supervisors obtained their N.D.D., whereas milk sampler testers completed one year only of the Diploma course.

4. "Others" include 2 assistant technical officers in the Ministry's Lime Department, a scientific officer in a seed testing station and an inspector of Salmon and Freshwater Fisheries.

5—8. University lecturers have taken good honours degrees and some higher degrees as well. Those in categories 6—8 include students with honours and pass degrees and 6 diploma students (in farm institutes).

9. Many degree students take farming posts, either to gain further practical experience or while awaiting other appointments, but a good many degree and diploma students are farming their own or family farms, or are farm managers. The 35 dairy students include 22 herdswomen and farm assistants (mostly women), of whom 9 completed their N.D.D.

10. These are at research institutes, university departments, and with commercial firms. Several in Category 12 are also in research posts.

11. The 21 included here were those actually engaged on research or further training when these figures were collected. In all, 32 did post-graduate research, 14 took courses in Agricultural Engineering, Dairying, Poultry or Crop Husbandry, 5 trained for teaching, 4 as Colonial Probationers, and 2 obtained experience abroad, making a grand total of 57.

12. Honours students are mainly in specialist posts as soil chemists, plant breeders, plant pathologists, pasture research officers and entomologists, while pass degree students are agricultural officers, soil conservation officers or in production and management work.

13. These include research, technical and advisory posts, posts as technical representatives, works chemists, assistant creamery managers, and farm inspectors with large dairy firms. Several students in Categories 10 and 14 are also with commercial firms.

14. Most of these students took only one year of the Diploma course. Fifteen are assistants in creamery laboratories, while 3 who completed their N.D.D. are in more senior posts of a similar nature.

15. This category comprises assistant experimental officers in the scientific Civil Service, Young Farmers' Club organizers, a library assistant and a few students in industrial or business posts not associated with agriculture.

16. A few students who left the College for National Service and subsequently returned are included in other categories. Completion of National Service before entering college has many advantages. Such students have a broader and more mature outlook, and should soon overcome the break in school studies. They are free from the distraction of uncompleted National Service and able to pursue uninterrupted studies and post-graduate work. Moreover, they seek employment while in close contact with their work and their tutors, and so avoid difficulties for themselves, their tutors and prospective employers which the present tendency to postpone National Service entails.

W. M. Ashton.

BOOK REVIEWS

The Agricultural Notebook (Primrose McConnell) (12th Edition). Facts and Figures for Farmers, Students and all engaged or interested in Farming. Farmer and Stock-Breeder. 35s.

Members of the older generation who used to keep their well-thumbed copies of "McConnell" ready to hand, will greatly welcome the appearance, after an interval of twenty-three years, of this completely revised edition. So much of the book is so well done that it is perhaps invidious to single out particular sections for special praise. But some of the authors—Dr. William Davies (on grassland), Mr. A. H. Hoare (on fruit and vegetables), Mr. W. C. Moore (on plant diseases), Dr. I. Thomas (on insect pests), and Mr. H. R. Davidson (on pigs)—have achieved masterpieces of condensation without omitting any point of real practical consequence.

Since it is to be hoped that further editions will appear at not over-long intervals, it may be useful to point out a few failings.

There are some omissions. Under Legislation there is no mention of the Hill Farming and Livestock Rearing Acts. The list of breeds of sheep omits a few, such as the Dalesbred, the Wiltshire Horn and the Radnor, that are of considerable local importance. More serious is the fact that whereas sheep scab, now virtually extinct, is adequately discussed, there is no mention of the menagerie of stomach worms which causes the flockmaster so many headaches. Again, there is no mention of fodder beet, apart from a note on the feeding value of the tops.

There has been an occasional failure to co-ordinate the several sections. The pig ration scale given by Davidson on p. 279 differs materially from that of Fishwick quoted on p. 345; there should have been no doubt as to which was the better authority.

Here and there, the arrangement of the information might be improved—the section on weeds is a case in point. There is, indeed, information about methods of control, including chemical control, and there is an adequate annotated list of weeds, with suggestions for control. But it would be very difficult to piece together the information required to enable the safe spraying of a particular crop infested by a particular collection of weed species.

Some of the information is rather seriously out-of-date. On some topics—for instance, weed control—any book must almost inevitably be out-of-date before it is possible to publish it. But the statistics of bull licensing, artificial insemination and milk records brings us to no later a period than 1949 or 1950.

Here and there one finds material that is hardly appropriate to a book of ready reference: information about the composition of the felspars or the plant proteins would commonly be sought, if wanted, in a textbook of agricultural chemistry.

Although the allocation of space, as between one topic and another, is generally very fair, there are a few exceptions. The most notable is the very adequate coverage of poultry diseases, in twelve pages, as contrasted with the very inadequate four-and-a-half allotted to all the other aspects of poultry husbandry.

But it is easy to find fault. The undertaking was one of very great difficulty, and must have involved an immense amount of labour on the part of the Editor, Dr. Ian Moore, who deserves our thanks for a most valuable service.

J.A.S.W.

Science and Fruit. Edited by T. WALLACE and R. W. MARSH. Bristol University. 30s.

This book tells the history of the Long Ashton Research Station; a history which epitomizes all that is best in agricultural and horticultural research in the United Kingdom. Initiated by the enterprise of private producers, supported by the State – at first modestly and then, as its value and importance grew, to an ever-increasing degree – adopted and fostered by the neighbouring University of Bristol, guided by two outstanding Directors, Professor Barker and Professor Wallace, and served by a long succession of distinguished and devoted workers, the station has grown to great scientific stature in fulfilling its task – the solution of the practical problems of fruit growing and processing.

The articles in this Jubilee volume tell of the many aspects of the work. They serve to remind us how wide must be the interests of those who hope to solve the problems of agriculture and horticulture, and how the search for the answers to these problems can sometimes lead the worker into apparently unrelated scientific fields with surprising and fruitful results.

It was a happy thought to make each chapter, apart from its contribution to the history of the station, an up-to-date and well-documented summary of a particular field of work. Some, notably those describing more recent activities, are of great value as individual reviews, and the book is well worth a place on the shelves of those interested in fruit growing

and processing for its scientific content alone. It would be difficult, for example, to find elsewhere in one article an account such as that by Professor Wallace of the effect of orchard factors on the keeping quality of apples.

The contents include sections on cider and fruit juices, on fruit culture, on plant nutrition (including a fascinating paper by Dr. Nicholas on the nutrition of fungi) on plant pathology and on domestic food preservation.

The stimulating and provocative Jubilee lecture given by Lord Rothschild forms an admirable opening paper. On these occasions, when we look back on the achievements of the past, we should also look forward and ask ourselves whether we are managing our affairs with the wisdom of our predecessors. Lord Rothschild has set out in his lecture the way he believes we must follow in the administration of research if, in the next fifty years, progress is to equal the proud record of Long Ashton.

W.K.S.

Science and Practice of Cropping for Meat and Milk. H. I. MOORE. Allen and Unwin. 14s.

In his latest book Professor Moore examines the problem of increasing meat and milk production from our own farms, by making greater use of our native resources. The author bases his solution on a greater production and better utilization of grass—as he terms it, " the master crop". Those conditions necessary to the establishment of good grass are lucidly stated and the techniques of better utilization, whether through the grazing animal or by better conservation methods, are fully described. In presenting his case along these lines, the author has undoubtedly focused attention on a weak link, that is, the grassland management on many farms. But there is a danger of overstating the case, and the average farmer needs guidance in the wider aspects of putting his land to its most profitable use ; the need for a proper balance in farm cropping programmes as between arable and grass and between cash and fodder crops is as fundamental to meat and milk production as is more and better grass.

This aspect has been touched upon in the chapter " Self-Sufficiency in Practice," but in my opinion a great opportunity has been missed. The treatment of the material under discussion (the cropping of a 350-acre farm) is too academic to appeal to the average farmer reader and in any case, can a problem of self-sufficiency be said to exist where, as shown, at least one-seventh of the farm is still available for cash cropping? Why are the livestock numbers limited to the extent they are ? Is it because cash crops give a better return per acre ?—or is it due to lack of buildings ?—or labour ?—or capital ? We are left in the dark, and so the picture of the farm organization as a whole is incomplete. Self-sufficiency is only one of the problems of farm management ; the economics of self-sufficiency, so vital to meat or milk production, have been disregarded.

There are photographs of a farm in the Yorkshire Dales and a small intensive dairy farm ; what a pity the author has not dealt with self-sufficiency on these two farms ! There is no comparable problem on the 350-acre farm taken as his example.

As a source of new ideas to the farmer, the book can be read with profit, and for the student it provides a summary of recent research in grass and root crop production, but the "practice" aspect, in my opinion, needs much more critical treatment if the book is to live up fully to its title.

K.N.R.

The Domesday Geography of Eastern England. H. C. DARBY. Cambridge University Press. 55s.

In the year 1085, in the twentieth year of the reign of William I, the Anglo-Saxon Chronicle tells us that during a visit to Gloucester " the King held a great council and very deep speech with his wise men about this land, how it was held, and with what men. He then sent his men over all England, into each shire, and caused them to find out how many hundred hides (units of assessment) were within that shire . . . what or how much each man that was settled on the land in England held in land and cattle, and how much it was worth . . . there was not a single hide nor yardland, nor an ox or a cow or a swine left out, that was not set down in his writing."

Whatever may have been the nature of the actual returns of this original precursor of the 1940 Farm Survey combined with a June 4th Return and Schedule D Assessment, the documents have long since been destroyed. Though King William's clerks knew nothing of the joys of punching cards and Hollerith machines, they proceeded to digest the returns just as thoroughly, rearranging the information on an ownership or feudal basis, then making local summaries. The main Domesday book was probably compiled from these local summaries.

The Domesday Book has long been used as a source of information on legal, economic and sociological conditions of the time, but its interpretation to yield a coordinated picture of land use and farming and the geographical distribution of woodland and wasteland on the one hand with the farming and land-owning population on the other has proved so difficult as to have been long neglected. The first task " must be to undo the work of King William's clerks, and to restore the geographical basis of the survey by piecing together the severed fragments of each vill". This is what Professor Darby and his team of co-workers have set out to do. The work was started on a county basis some years ago, interrupted by the war, discontinued by the faint-hearted but never far from the thoughts of the leader.

The present volume is the first of a projected series of six and deals with the eastern counties from Lincolnshire to Essex, including Cambridgeshire and Huntingdonshire. It is a model of its kind : well-arranged, scholarly, fully documented and copiously illustrated by beautifully clear maps ; yet it remains eminently readable. What perhaps is most fascinating is the way in which anyone knowing the farming regions of today can see those regions already differentiated nearly nine hundred years ago. There are some major changes, most notable being the draining of the fens, but on firm ground differences in soil and relief had already led to the differences in land use and in relative land values which exist today. There could surely be no clearer proof of the fundamental and continuing influence of physical factors : inherently good land is able to stand up against centuries of economic vicissitudes and remains productive. There is a meaning in " good agricultural land " and its value to the nation. Even details of farm practice were already firmly established in Domesday times—as when Essex farmers living on the uplands had each their share of the fattening pastures of the Essex marshes.

In the space of a short review it is impossible to do justice to this volume, the first fruits of a great work. How much easier would have been the task, how much more complete the results if only the original returns had been kept ! This is a lesson for today. No one in the future will ever know the land ploughed in the 1918 campaign and the results obtained. The records were destroyed.

L.D.S.

Output and Expenses of Agriculture in Some European Countries. (Agri/42). Food and Agriculture Organization, 12s. 6d.

The need to produce more food in Europe is well recognized, and in attempting to achieve this it is necessary that the general economic and social framework within which farmers have to operate should be well known. In this volume, F.A.O. have brought together some of the basic facts and figures on agricultural output and costs for fourteen different European countries, including France, Italy, the Scandinavian countries, Switzerland and the United Kingdom. This information is regarded as fundamental to the formulation of rational agricultural policies, although there are also other factors which merit examination if information is available.

The report falls into two parts. The first of these is a general review in which the main features are shown in the form of international comparisons. The second part presents the information for each of the countries separately and compares the pre-war and post-war positions.

It should be noted that the individual country estimates are not uniform in method or degree of reliability, although it is believed that this does not invalidate the comparisons which are made. The study is admittedly more descriptive than analytical, but it contains much interesting and revealing information. British farmers will be pleased to read that net output per head of agricultural population was highest in the United Kingdom, being greater even than that in Belgium and Denmark. Our output per hectare also compares favourably with that of the other countries covered by this report. It is perhaps surprising to learn that, in 1950, 14 per cent of our output by value came from egg and poultry sales, as compared with 9 per cent in Denmark. On the other hand, pigmeat accounted for only 8 per cent of our output, as against 27 per cent in Denmark. Milk and milk products represented 30 per cent of output in both countries. There is also a short, but useful, chapter in which questions of methods of estimation and definition are discussed.

Altogether, this study, which is believed to be the first of its kind, is a welcome and valuable contribution to our knowledge of European agriculture.

L.N.

Fruit and Vegetable Storage and Pre-packaging. Anglo-American Council on Productivity. 3s.

In the autumn of 1951, under the auspices of the Anglo-American Council on Productivity, a team comprising representatives of growers, wholesalers and retailers, together with members of the N.A.A.S. and Marketing Division of the Ministry of Agriculture, spent

six weeks in the United States studying short-term storage and pre-packaging of fruit and vegetables. The team's report contains a considerable amount of information not previously gathered together in one volume, some of which is new to this country. It discusses both the extent of the use of the techniques described and their possible application in Britain.

During the course of a tour of some 9,400 miles in the U.S.A. a great deal of information on the methods used to keep fruit and vegetables fresh over long periods was collected, some of which may prove to be worth trying under British conditions, either to level out peak periods of production or to present perishables to better advantage. Descriptions of the way in which ice and refrigeration are used to keep vegetables fresh, and the cooling, washing and packing of produce for journeys of 3,000 miles and of up to ten days' duration, are particularly interesting. The use of chemicals in washing water, the extent and methods of pre-packaging fruits and vegetables in consumer units, types of film wraps and their particular characteristics and use are also discussed.

In its conclusions, the team draws attention to the need for more research on these matters in Great Britain, although a number of the problems are, of course, already being investigated under the direction of the Joint Working Party on Waste and Deterioration of Fruit and Vegetables.

F.J.G.

Practice with Science. ALEC HOBSON. Royal Agricultural Society of England.

Ever since its foundation in 1838, when it was known as the English Agricultural Society, the R.A.S.E. has been in the forefront of farming progress. Its history is virtually the history of agricultural advancement in Britain.

In these circumstances, it is not to be expected that even so adept an organizer as Alec Hobson could encompass the story of the Society in the twenty-four pages of this free booklet. For those who seek detail, however, the subject has already been dealt with very fully by Sir James Scott Watson in his *History of the R.A.S.E.* What Mr. Hobson has attempted to do, and in fact does admirably, is to indicate the main facets of the Society's policy, the many ways in which the R.A.S.E. has made its mark, and the service it continues to give today.

Briefly we are taken through the Society's main achievements, both past and present. Its best known feature—the "Royal"—with the encouragement it gave in the late nineteenth century to stock breeding, cider-making and a dozen other aspects of farming; the stimulus to mechanization imparted by trials and the offer of money prizes (the latter practice being revived in the last few years in competitions for forage crop collectors and potato harvesters); active participation in, and encouragement given to, all manner of scientific and field research; the establishment of the N.D.A. and N.D.D. examinations; the translating of science into practice in its publications. Lastly, there is a short section on post-war activities.

In all, this booklet is an extremely useful and interesting introduction to the objects and history of this great society, which should prove of value to old and new members alike.

L.W.T.

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